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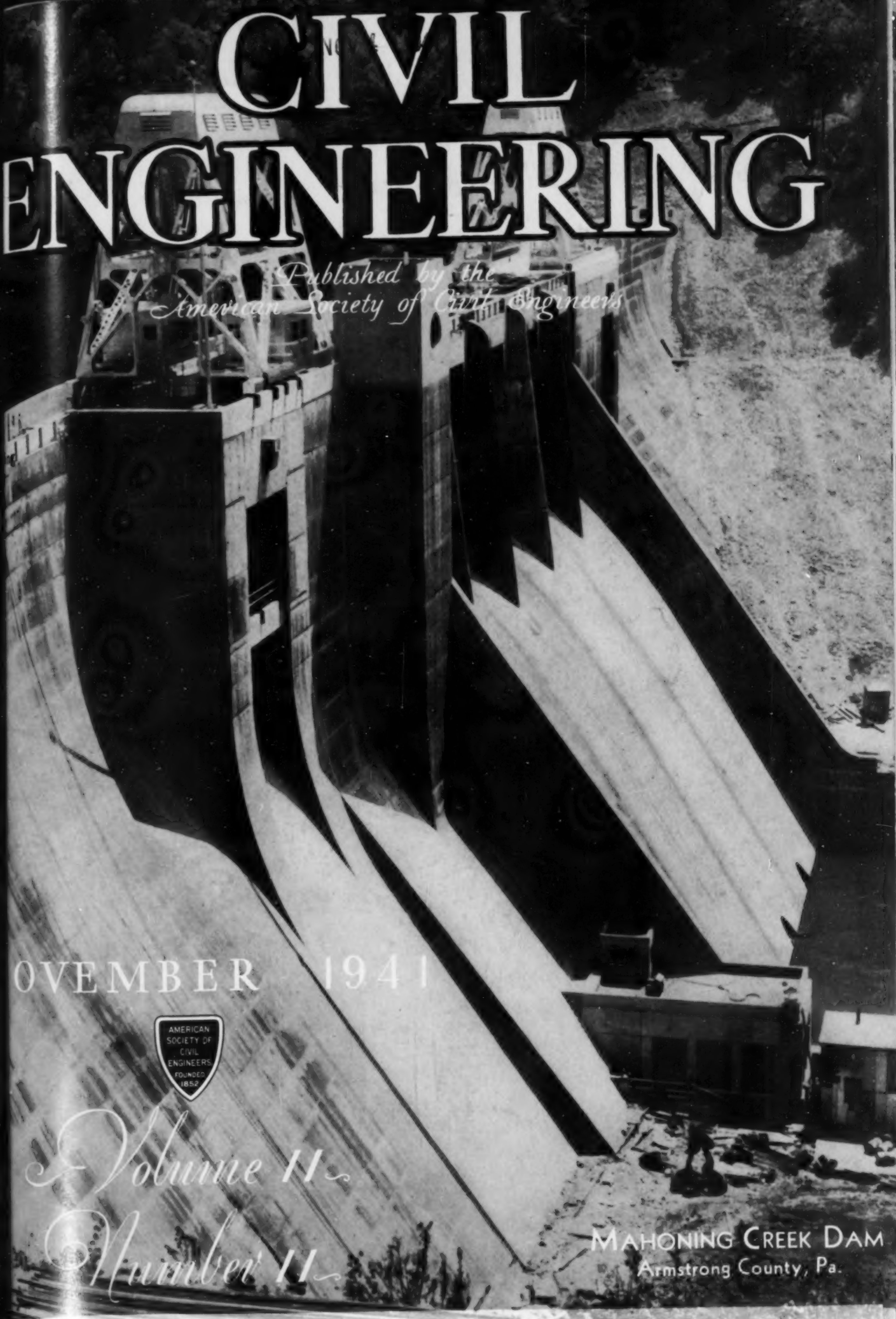
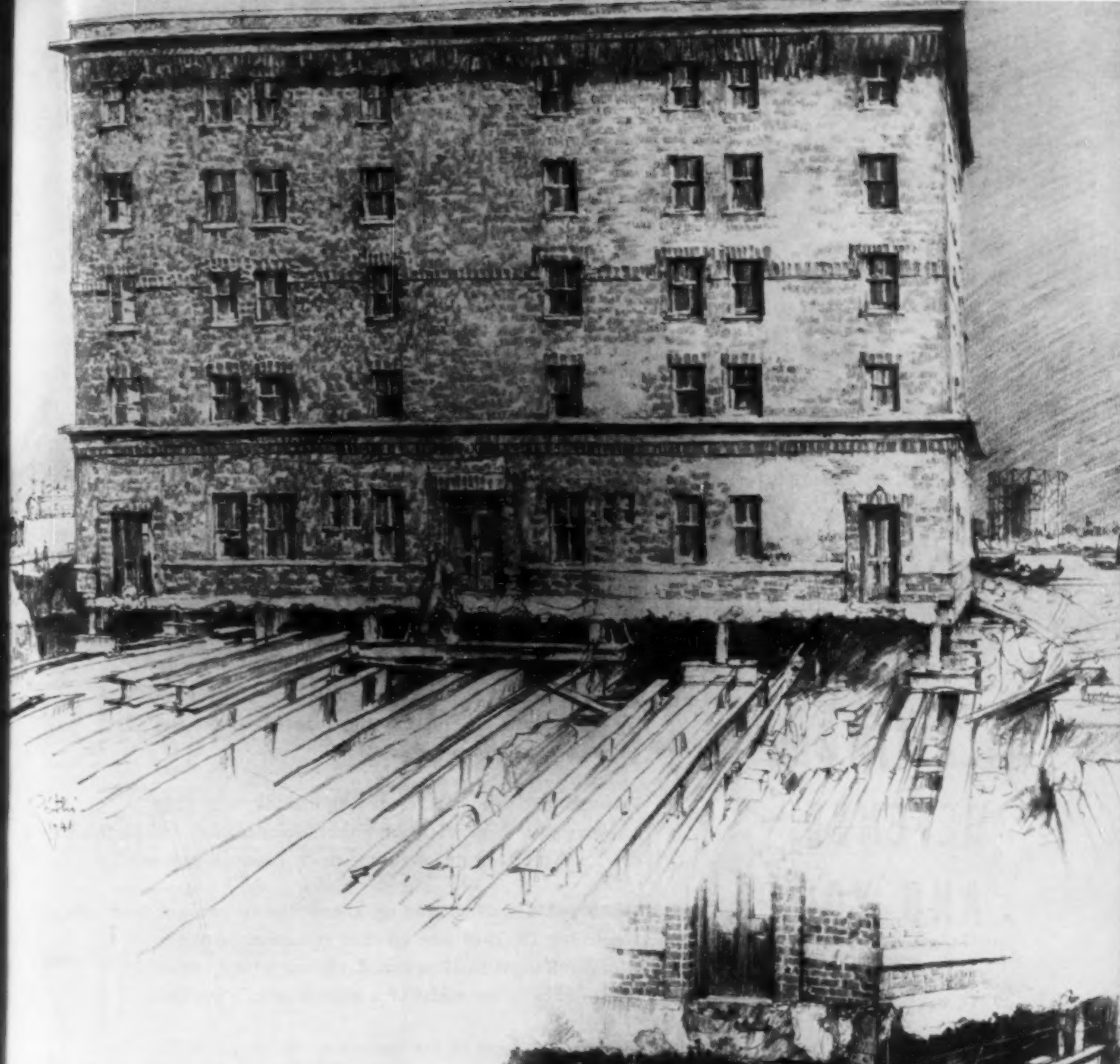


MAHONING CREEK DAM
Armstrong County, Pa.



MOVING

Five-Story Hospital Moved to Make Way for New East River Drive — New York, N.Y.

Among Our Writers

H. L. Fruend (U. of Mich., B.S. in C.E., '09) has been on the staff of the TVA since 1933 in capacities ranging from Senior Engineer to Assistant to the Director of the Commerce Department. Prior to that he was associated with the Fargo Engineering Company, the Miami Conservancy District, and Stone and Webster. In private practice he has been a consultant on power development, traffic engineering, and municipal problems.

Wilfred Bauknight (U. of So. Carolina, B.S. in C.E., '32; C.E., '37; Carnegie Tech., M.S. in C.E., '40) is a member of Phi Beta Kappa and Sigma Xi. Since 1932 he has been with the U.S. Engineer Department in the Memphis, Louisville, Nashville, and Pittsburgh districts.

F. W. Haselwood (Kans. State Col., A.B., '01) did graduate work in civil engineering at Stanford U. 1901 to 1904, followed by railway location and construction. Since 1912 he has been engaged in highway work in California and has been state district engineer in District III at Sacramento, I at Eureka, and II at Redding, where he now has charge of 1,380 miles of California state highway.

Fred D. Pyle (Utah Agricultural Col., B.S. in C.E., '03) has had irrigation experience on the Umcompahgre Project, Columbia Irrigation District, Imperial Irrigation District, and Vista Irrigation District. For the last 7 years he has been hydraulic engineer in charge of water development for the City of San Diego.

John D. Galloway (Rose Polytechnic, B.S., '89) opened a consulting office in 1900 and for 41 years has engaged in bridge and building design, hydroelectric power plant design and construction, irrigation, and related subjects. During the World War he served for 14 months in France as a major in the Engineer Corps. An interest in the historical aspects of engineering led to the preparation of the articles on Theodore Judah.

Lester S. Ready (U. of Calif., E.E.) has been on railway and power work in California since 1913. From 1923 to 1926 he was chief engineer of the Railroad Commission of the State of California and from 1934 to 1936 he was chief consulting engineer, National Power Survey and Electric Rate Survey of the Federal Power Commission. In addition he has been consultant to the California Water Project Authority, to the public utility commissions of Utah and Hawaii, and to various Pacific Coast municipalities, and irrigation and utility districts.

J. Trueman Thompson (Johns Hopkins, B.E., '17) after service as captain, Corps of Engineers (A.E.F.), became an instructor at Johns Hopkins and is now head of the civil engineering department. Since 1921 he has been connected with the U.S. Public Roads Administration, his duties being in the field of research.

Charles B. Spencer (Columbia U., A.B. '07, C.E. '10), Sigma Xi, after a period with the Underpinning and Foundation Co. and service in France as a Captain of Ordnance, became vice-president of Spencer, White and Prentis, Inc., in 1919. This firm from its inception until now has been identified with notable work throughout the country, such as locks and dams on the Mississippi, subway construction, foundations and underpinning, aqueduct tunnels, drydocks, and U.S. Navy defense work.

J. A. Guissinger has been with the Arkansas State Highway Commission in various responsible positions for the last 8 years. Prior to this he has had extensive construction experience on highway, paving, sanitary, and water supply work in Tennessee, Georgia, and Arkansas.

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Something to Think About

A Series of Reflective Comments Sponsored by the Committee on Publications

The Battle Front for Internal Defense

By H. L. Fruend, M. Am. Soc. C.E.

Assistant to Director of Commerce Department, TVA, Knoxville, Tenn.

In the present world crisis, we are in for a real storm. Not only temporary but permanent adjustments will have to be made in customary ways of life. We engineers should be thinking of the part we are to play in these adjustments and the implications they hold for the profession in general. Let us consider the thesis that to be accorded public recognition as one of the professions, engineering must concern itself with plans for advancing the public welfare and the common good.

Predictions of what lies ahead are being made by columnists, economists, politicians, writers, and lecturers. The fact that all of these sound more or less plausible merely indicates the confusion we are in, and that no one knows the real answer or can predict the final outcome.

An Engineering Job.—This war is a carry-over of racial and economic inequalities that should have been adjusted long ago. It is going to be finished by the middle and lower working classes, who are taking on an ever-increasing share of the burden of government. Ernest Bevin, second only to Churchill in Britain's struggle, holds that the war must be followed by "the economic reconstruction of the whole foundation of society.... The task of rebuilding the world has to be done by the working class." But whether capitalism, socialism, or totalitarianism survives, engineers will be needed. Only as we accept responsibility for advancing the general good, will we rise to the level of a true profession.

Up to now, we have been the hired hands to carry out the plans and schemes of others both in business and in public life. It is only natural that our attention so far has been concentrated on technical rather than social advancement, on structures and mechanisms rather than on humanitarian considerations. It has been our job to master the physical forces of nature and in so doing we have amplified the physical power of man. Unless a way can be found to direct this amplified force into constructive and not destructive channels, our contributions to civilization may prove abortive.

America in a Favorable Position.—According to economists, America is bound to be the leading democracy in the new world order because it has the greatest potential security, and industrial and technological power. Note the emphasis on engineering. A plethora of pet schemes and political nostrums for reconstruction is even now being advanced. The job of evaluation should be as much one of engineering as of statesmanship, education, or law. Is the engineering profession ready for such a destiny? The preparation is going to jar many of our basic concepts of political and industrial economy.

It seems to be a foregone conclusion that in the end the European powers, at least, will be bankrupt. After the last war, international obligations were repudiated. After this conflict, the slate may have to be wiped clean. As far as the internal economy of this country is concerned, we probably will owe ourselves more money than we can pay back to ourselves. But in real wealth, in factories, in utilities, in machinery, in skilled labor, and in our ability to work and in our capacity to produce, we will be greater than ever. And we still will be rich in natural resources.

The Problem Ahead of Us.—But we will lack an adequate market to consume all that we can produce. Consequently we are going to have to revise our methods of foreign and domestic commerce, to level artificial restrictions and barriers to the free flow of trade, to eliminate special privilege, and to learn how to distribute the net proceeds more equitably. If we can tackle these problems with the same vim and persistence we now devote to opposite measures, we can raise the standard of living for a vast reservoir of potential customers who are now able to afford only the basic necessities of life.

There is nothing to be gained by becoming pessimistic, or by getting red in the face and violently denouncing isms and ideologies as the cause of the present unrest. Those are only symptoms of a deep-seated malady which needs a major operation. The basic irritation is the inequitable distribution of wealth.

There is nothing new or revolutionary in this concept. In 1830 Daniel Webster said, "It is too much to expect that the universal franchise and inequitable distribution of wealth will lie together peacefully for long." Bismarck claimed that Europe should never have allowed the American commonwealth to survive the Civil War, pointing out that for the first time a free electorate were in a position to vote themselves whatever they wanted.

The Necessity for Planning.—A prominent mechanical engineer and industrialist advocates the immediate creation of a small group of the ablest men in the country "to devote their entire time to the formulation of the best plans that could be evolved for the utilization of our entire resources for the improvement of our standard of living, for the protection of our national economy from the repercussions not of war but of peace, for the conversion of the processes of economic waste to the processes of economic usefulness" ("Through a Glass Darkly" by W. L. Batt, *Mechanical Engineering*, January 1941).

Inasmuch as the problem is the promotion of public welfare through improvements in the standard of living, protection of national economy, and conversion of waste, it is essentially technological in character. One lesson taught by the depression is that such plans cannot be drawn overnight. Engineers and engineering should take on this fundamental problem as their main professional objective.

An abstract report in itself will avail nothing; witness the excellent and carefully compiled report of the Hoover Committee on Social Trends. Nor is it probable that a super-group of intellectuals can do the trick except under a totalitarian government. Therefore if we are to retain our democracy, steps must be taken to enlist and retain the interest and support of all classes and factions in the formulation of plans. The battle front for internal defense must be formed with the same care and precision as that for external defense against foreign aggression.

Three Possible Initial Steps.—In line with this general plan, three initial steps are herein proposed for the immediate consideration of the Society and of the profession in general. It must be remembered that these are only the first high hurdles in the long race ahead. But if we can learn how to take them and to thus improve our stride, there is hope of eventually winning the race.

1. *National Department of Public Works* to draft a comprehensive schedule of public improvements for normal as well as emergency construction. This means a planning agency with power to take up through a system of public works the inevitable slack of employment in private industry. There is too much to be done towards improving living, housing, and working conditions of the vast majority of our working people to condone long periods of enforced idleness. If we are to pay unemployment insurance to able-bodied workmen who would rather be engaged in worthwhile tasks than in supervised leisure, then it would seem that accumulated insurance reserves could be used to pay limited wages, rather than just a dole, on public projects built primarily for the direct benefit of the workers themselves, their families, and their fellow men.

Such a proposition is going to require a great deal of revised thinking on the part of both private capital and organized labor. From present indications we are going to learn how this can be brought about during national emergencies. The job is far too big to be handled as a sideline of our military program, and it is much too vital to be dependent upon the usual tactics of pork-barrel legislation. A General Board of Review should have a standing comparable with that of the Supreme Court.

Whereas now engineering may be compared to an intermediate pinion engaging the larger drive wheels of both capital and labor, under a coordinated system of public and private enterprise, it could become the synchroscope by which one or the other or both could be brought on the line at the proper time to carry the load.

2. *State Industrial Research Councils* to study and promote the better utilization and conservation of essential natural resources. It is going to be necessary to safeguard for the purpose of national defense and general welfare, the strategic and essential resources of the land, waters, and mines of the country. To permit private ownership to continue to skim the cream off of irreplaceable natural resources for the sake of quick profits, will lead eventually to want. Within the limits of reasonable prudence, steps should be taken to regulate the best usage, and the first cost of raw materials must not be the sole controlling factor. Wherever poorer grades of materials can be used at no sacrifice in quality of the ultimate product, such grades should be recovered and utilized along with the higher grades so as to eliminate unnecessary waste and to avoid future shortage.

New methods should be developed for better recovery and new processes evolved to use more completely all possible by-products. The problems are those requiring close cooperation between science and industry, to be studied in local laboratories near sources of supply and production, and to be coordinated through some central agency. The benefits of scientific research should be made available to small as well as large industrial units, if we are to retain an industrial as well as political democracy.

3. *Solidarity of the Entire Engineering Profession* through some recognized functional agency. Although this step is listed as third in order of importance, it is really first in order of time, because without a united front, the engineering profession's influence on government and public affairs will continue to remain insignificant. Through the stimulus of greater efficiency under some form of unified control, the world of tomorrow will continue undoubtedly to be run by strong minorities or coalitions. It is not intended to imply that engineers should form another strong pressure group to compete for public favor, but to point out that the profession can be of maximum service through concerted rather than individual action. It is indispensable that such an agency be accorded the supremacy, loyal support, and vigorous direction of the entire profession.

The Challenge to the Profession.—The larger problem of adjustments to the social order is one engaging the attention of thoughtful men in every profession. If the true professional attitude is one of service to others, then we engineers have an especial responsibility for such service because, in the first place, engineers are responsible for the new weapons which make modern warfare so diabolical. In the interests of science, a Frankenstein has been fashioned which is being used to destroy the culture we have been so long in building up. Secondly, the nation is now depending upon engineers to gear up production to an unprecedented speed in order to protect itself from aggression. Some day it will turn to us and demand that we put on the brakes and decelerate the industrial machinery for war without skidding and going into the ditch.

If we are to be real leaders instead of mere followers, we must be ready with a definite plan. There is a big job ahead to be done. Are we ready to tackle it?

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Construction for Flood Control at Pittsburgh

By WILFRED BAUKNIGHT, JUN. AM. SOC. C.E.
ASSOCIATE ENGINEER, U.S. ENGINEER OFFICE, PITTSBURGH, PA.

FLOODS on the Monongahela and Allegheny rivers and their tributaries have caused major damage over a long period of years. In flood stages these rivers present a frightening sight. River-bank homes and businesses are evacuated while houses and haystacks ride swiftly by as though on a highway. Relief for this situation involves many elements, from flood control dams on the upper tributaries to local flood protection in certain communities. In this paper Mr. Bauknight tells of the present construction program being carried out by the U.S. Engineer Corps to relieve the flood menace in the Pittsburgh area.

A SYSTEM of reservoirs for flood control in the Pittsburgh area is rapidly becoming a reality. Begun with the construction of Tygart Dam in 1935–1938, the ultimate program now includes a total of possibly ten reservoir projects. When this entire program is completed, approximately 40% of the drainage area above Pittsburgh will be controlled.

During the six years that have elapsed since the start of the construction program, work has advanced at a rapid rate. Three dams have been completed and are in operation, and a fourth is nearing completion. Construction is progressing at the sites of the fifth and sixth projects. Preliminary studies for a seventh are completed, and final plans can be turned out on short notice when the "go" signal is given. When these seven projects are finished, the height of a flood of the severity of the 1936 catastrophe will be reduced by about 8 ft at Pittsburgh. Other projects in the system of reservoirs for the protection of Pittsburgh are under study at the present time.

Agitation for a system of flood control reservoirs for Pittsburgh and vicinity dates back to shortly after the turn of the last century. When the area was visited by a disastrous deluge in 1907, a united cry for protection arose. Comprehensive studies were made and plans developed by the Pittsburgh Flood Commission, an organization composed of business men, engineers, and other professional men in the Pittsburgh area. The Commission's excellent report of 1911 recommended, among other things, that a system of reservoirs be constructed. Definite action was not taken on the recommendation at that time, however, and no results in the way of authorizations for construction were obtained until 23 years later.

In 1934, as a result of Congressional action, Tygart Dam was established as a federal project for navigation and flood control purposes. Actual construction was started in January 1935. In March 1936, when the construction of the dam was well under way, Pittsburgh was visited by the worst flood of its history. The water rose to a peak 7.3 ft above the record previously set by the 1907 disaster. Damage in the Pittsburgh Engineer District was estimated at about $180,000,000. A few months later, Congress authorized the construction of nine additional reservoirs in the area. However, an Act of June 28, 1938, extends the authority to the Secretary of War and the Chief of Engineers to modify the project as required.

Tygart Dam, the first project to be started under the program, in addition to its use for flood control, provides storage for discharge during low-water seasons in the interest of navigation. Construction was completed in February 1938, almost a year ahead of schedule. The total cost was $18,500,000, of which $4,600,000 was for relocation of a branch line of the Baltimore and Ohio Railroad.

This concrete gravity structure located on the Tygart River about $2^1/_4$ miles above the City of Grafton, W.Va., controls a drainage area of 1,183 sq miles with a maximum recorded flow at the site of about 65,100 cu ft per sec. The maximum height of the dam above the foundation is 232 ft and the overall length is about 1,920 ft. A total of approximately 1,250,000 cu yd of concrete

TYGART DAM IN WEST VIRGINIA, THE FIRST MAJOR STRUCTURE IN THE PITTSBURGH FLOOD CONTROL PROGRAM

TIONESTA DAM IS OF THE COMPACTED EARTH-FILL TYPE
Quarry-Run Rock Fill Protects Upstream Face

was required in the construction. The site was selected after a careful survey of all available locations. The general topography, the quality and depth to satisfactory foundations, and preliminary cost estimates pointed to a concrete-gravity type structure. The general construction contract was held by the Frederick Snare Corporation under the direction of Randall Cremer, M. Am. Soc. C.E., vice-president. Majors W. E. Potter and B. F. Fowlkes were successively officer in charge, and C. H. Wagner, M. Am. Soc. C.E., was resident engineer.

INVESTIGATIONS FOR TIONESTA DAM

Tionesta Dam is the most northerly of the dams now completed or under construction. It is located on Tionesta Creek about 1.2 miles above its junction with the Allegheny River, and controls a drainage area of about 483 sq miles with a maximum recorded flow of 22,300 cu ft per sec. Construction was begun in the early spring of 1938 and completed in December 1940. The cost of the entire project was approximately $5,400,000. The general location of the site was so favorable in regard to cost and flood control storage that other possible sites were quickly eliminated. The exact location for the axis of the dam was determined by a careful study of costs. The foundation was fully investigated by core borings and test pits.

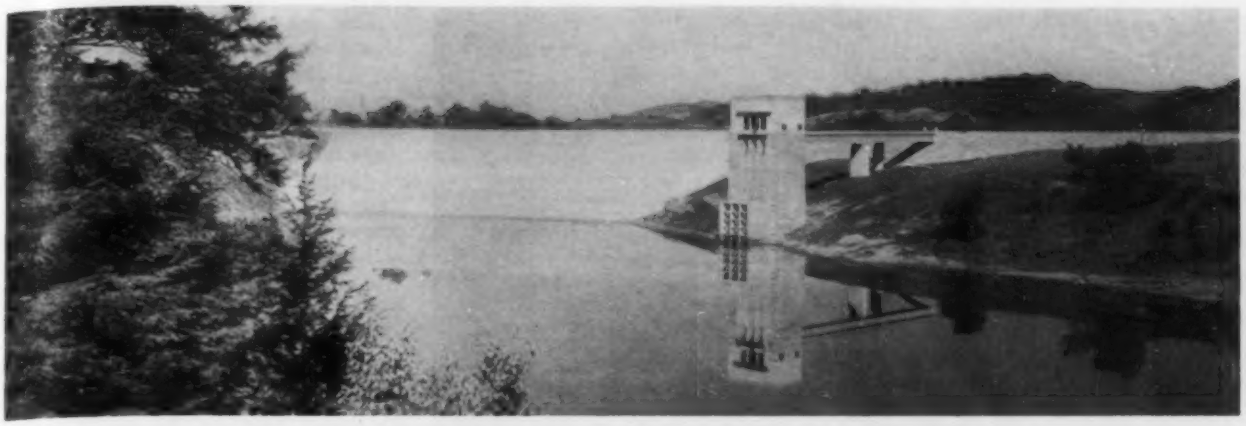
Preliminary designs of two concrete and two fill-type dams were made for this site. The cost of each type was estimated. One design assumed a straight concrete-gravity dam with a gated spillway crest. A second provided a round-head concrete buttress type, also with a gated spillway crest. Comparative estimates showed that the straight concrete-gravity dam would cost about 40% more than a rolled-fill dam, as considered later, primarily because of the large amount of overburden that would have to be removed in reaching a satisfactory foundation. The round-head buttress type was found to cost slightly more than the gravity type.

Of the two fill-type dams considered, one was of rolled-fill design and the other a combination of earth and rock-fill with the great mass made up of dumped rock. The estimates showed that, owing to the quantity of borrowed rock required, the combination earth and rock-fill dam would cost 15% more than the rolled-fill type, and the latter was selected.

This type utilized, to the best advantage, materials that had to be removed from the spillway. The topography of the site and the position, in elevation, of the geologic formations were such that an earth dam was highly favored. There is a complete bend in the river at the site, forming a suitable location for the 19-ft-diameter tunnel outlet. A broad saddle some distance from the bend provides an ideal location for the spillway, which is lined with concrete for a short distance near the upstream end. The maximum height above stream-bed is 154 ft and the overall length is 1,050 ft.

The general construction contract was held by S. J. Groves and Sons Company and Lundin Brothers. E. J. Cox was in charge of field operations for the contractor. Capt. J. K. Herbert was officer in charge for the Govern-

EARTH-FILL SECTION OF CROOKED CREEK DAM BEING COMPACTED WITH TRACTORS, SHEEPSFOOT ROLLERS, AND EARTH-MOVING EQUIPMENT



Upstream Face of Crooked Creek Dam Is Protected with Rock Fill

ment. W. B. House, resident engineer for part of the job, was succeeded by G. P. Fleetwood.

EARTH FILL CHOSEN FOR CROOKED CREEK DAM

Crooked Creek Dam, located on the creek of that name near Ford City, Pa., is an earth-fill structure, with heavy rock blankets on both upstream and downstream slopes. The maximum height above the stream bed is 143 ft, and the length of the embankment section is 1,480 ft. The dam contains approximately 950,000 cu yd of rolled fill and 495,000 cu yd of rock fill. A gate-controlled tunnel $15^1/_2$ ft in diameter and 1,320 ft long, provides for discharge through the right abutment. The tunnel terminates in a stilling basin a short distance downstream from the toe of the dam. Extending across the right abutment is the saddle spillway, lined with concrete near the upstream end, which empties in the creek a short distance below the tunnel outlet. The drainage area above the dam is 278 sq miles, and the maximum recorded discharge is 20,900 cu ft per sec. The cost of the entire project was about $4,600,000.

Early in the reconnaissance, it became apparent that the general location finally adopted had many advantages over other possible sites. Detailed studies were therefore limited to that location. The axis location first investigated was 400 ft downstream from the one finally selected. The shift was made to secure a saving in costs disclosed by the topographic survey.

As in the case of Tionesta Dam, preliminary designs and cost estimates were made for four types of dam for this location. It was found that a straight concrete gravity type would cost more than a rolled-fill type with separate appurtenant works; a dam of the round-head buttress type would cost slighty more than the concrete gravity type; and an earth and rock-fill dam would be more expensive than the rolled-fill type. Since the rolled-fill type was found to best utilize the materials available and to show savings in cost over the other types, this design was adopted. The contract was held by George M. Brewster and Son, Inc. Edward F. O'Neill was in charge at the site for the contractor, Capt. J. K. Herbert was officer in charge for the Government; and G. P. Fleetwood was resident engineer.

MAHONING DAM, OF CONCRETE GRAVITY TYPE

After having ventured into earth dam construction at Tionesta and Crooked Creek, the U.S. Engineer Corps returned to a concrete gravity type at Mahoning. This dam is located on Mahoning Creek, one of the smaller tributaries of the Allegheny River. It controls a drainage area of 341 sq miles with a maximum recorded flow of 24,100 cu ft per sec. The estimated cost is approximately $6,500,000.

Four possible sites were investigated. A site near the mouth of the creek offered control of the maximum drainage area, but investigation revealed that a structure there would be costly because of the breadth of the valley at that point. Also, extensive railroad relocation would be involved.

Whirley Cranes Mounted on Temporary Steel Construction Bridge Placing Concrete on Mahoning Dam

Two sites were considered at a location about 24 miles above the mouth of the creek, where the creek makes a hairpin loop and the topography lends itself favorably to an earth dam with a short saddle spillway across the nose inside the loop, and a short tunnel through the nose. Definite sites were investigated just upstream and just downstream from the bend. These sites were not considered with favor, however, since the narrow nose was found to have very doubtful subsurface characteristics, in the form of shattered rock which would require expensive treatment.

The site finally adopted was located approximately 2 miles downstream from the hairpin bend, and about 22

MIXERS DELIVERED CONCRETE TO TRUCKS FOR PLACEMENT BY STIFF-LEG DERRICKS IN CONSTRUCTION OF LOYALHANNA DAM

miles above the mouth of the stream. The river at this point passes through a comparatively narrow valley. Explorations by core borings and by 30-in. shafts were made. The rock was found to be adequate for the foundation of a concrete gravity dam.

Several types of dams were considered. An earth dam was found to be out of the question since no opportunity was afforded, within economical limits, for either a saddle or a side-channel spillway. A round-head buttress-type dam was found to be slightly higher in cost for this location than a concrete gravity type, and to contain other features somewhat less favorable. A concrete gravity-type dam was therefore chosen.

The dam, as designed and constructed, is 160 ft high, and has an overall length of 993 ft. The centrally located spillway section is 192 ft long. Approximately 343,000 cu yd of concrete were required in the construction. The dam was constructed by the Dravo Corporation, for whom D. P. Childress was superintendent in the field. C. H. Wagner, resident engineer for the Government during the early operations, was succeeded by J. I. Bowman.

Mahoning Dam was followed by another concrete gravity dam on Loyalhanna Creek, also a tributary of the Allegheny River. The drainage area controlled by Loyalhanna Dam is 291 sq miles, and the maximum recorded flow at the site is 34,200 cu ft per sec. The estimated cost is $5,700,000. The dam is located about 4.5 miles above the junction of Loyalhanna Creek and the Conemaugh River at Saltsburg, Pa. This site was selected after investigating three possible locations.

Preliminary designs were developed for two alternate types of structure—one a concrete gravity type extending the entire width of the valley, the second, a main concrete gravity section and an embankment section at the shoreward end of the left abutment. The latter design resulted in a substantial saving, and was adopted.

As finally designed, the dam is 113 ft high above the stream bed and has an overall length of 970 ft. Approximately 120,000 cu yd of concrete and 42,000 cu yd of fill will be required in the construction. The contractor is the Great Lakes Dredge and Dock Company, for whom Sam J. Wright is job superintendent. Ralph Patt is resident engineer for the Government.

The construction of Youghiogheny Dam is being accomplished in two parts. The first, consisting of the outlet tunnel and appurtenances, is well advanced and is scheduled for completion early in 1942. Construction of the second part, consisting of the dam and spillway, is in the preliminary stages. This dam will be a rolled-fill structure located on the Youghiogheny River, a tributary of the Monongahela River. It will control a drainage area of 435 sq miles with a maximum recorded flow of 46,200 cu ft per sec. The approximate cost of the entire project is $9,000,000.

The dam will be 184 ft high above the bed of the stream and 1,600 ft long overall. The embankment will contain approximately 3,530,000 cu yd of fill. Upstream and downstream faces will be protected by heavy blankets of dumped rock. The contract for the outlet works is held by Herman Holmes, for whom A. J. Cole is superintendent. The contract for the embankment and spillway is held by the Hunkin Conkey Construction Company; and Shofner, Gordon and Hinman, with V. F. Robertson as superintendent. C. H. Wagner is resident engineer for the Government on both contracts.

JOHNSTOWN CHANNEL IMPROVEMENT PROJECT

While the major flood-control activity is in connection with reservoirs for the protection of Pittsburgh and vicinity, there are some local protection projects worthy of note. Two flood walls have been constructed, one at Wellsville, Ohio, and the other at Kittanning, Pa. The major project for local protection, however, is the improvement of river channels at Johnstown, Pa.

The City of Johnstown has suffered many devastating floods. These have resulted primarily from the restricted condition of the channels of the Conemaugh and Little Conemaugh rivers and Stoney Creek within the city. The present project consists of widening and deepening the channels so that bank-full capacities within the city will be increased to about four times the capacity before the work was undertaken. The entire cost of the improvement will approach $8,670,000. A. L. Hertz, M. Am. Soc. C.E., was project engineer for the Government until June 1941. Since that time C. E. Paul has been project engineer.

Major floods are difficult to control, especially in a thickly populated, industrial drainage area where the cost of lands and damages is high. In spite of difficulties, Pittsburgh has mapped out for itself a program that offers a reasonable degree of protection for an expenditure that will be justified by the resulting benefits. A major portion of this program has been completed.

This program is under the supervision of the U.S. Engineer Office, Pittsburgh, Pa. Four District Engineers have been stationed at Pittsburgh since the program started, namely, Col. W. D. Styer, Lt. Col. W. E. R. Covell, Col. L. D. Worsham, and Lt. Col. D. L. Hooper. Maj. H. D. Vogel is assistant to the District Engineer. C. M. Wellons is principal engineer. D. P. Keelor has charge of inspection of the construction. The writer is employed as associate engineer in the Inspection Division of the Pittsburgh office. Messrs. Covell, Worsham, Vogel, Wellons, and Keelor are Members, Am. Soc. C.E.

Highway Relocation for Shasta Project

Many Problems Solved in Moving 18 Miles of Pacific Highway

By F. W. Haselwood, M. Am. Soc. C.E.

District Engineer, District II, California Department of Public Works, Division of Highways, Redding, Calif.

The old "emigrant route" north of Redding, Calif., goes through as rough a country as ever was traversed by stagecoach. The one-track ruts and turnouts, cutting deep into the mountain sides, can still be followed with ease. Alongside of it is the present Pacific Highway, U.S. 99, which had to be relocated around the lake to be formed back of Shasta Dam. No greater contrast in highway construction is to be found anywhere—on the one side the tortuous stagecoach route clinging to the heavily forested mountain sides, on the other the modern highway here described in some detail by Mr. Haselwood.

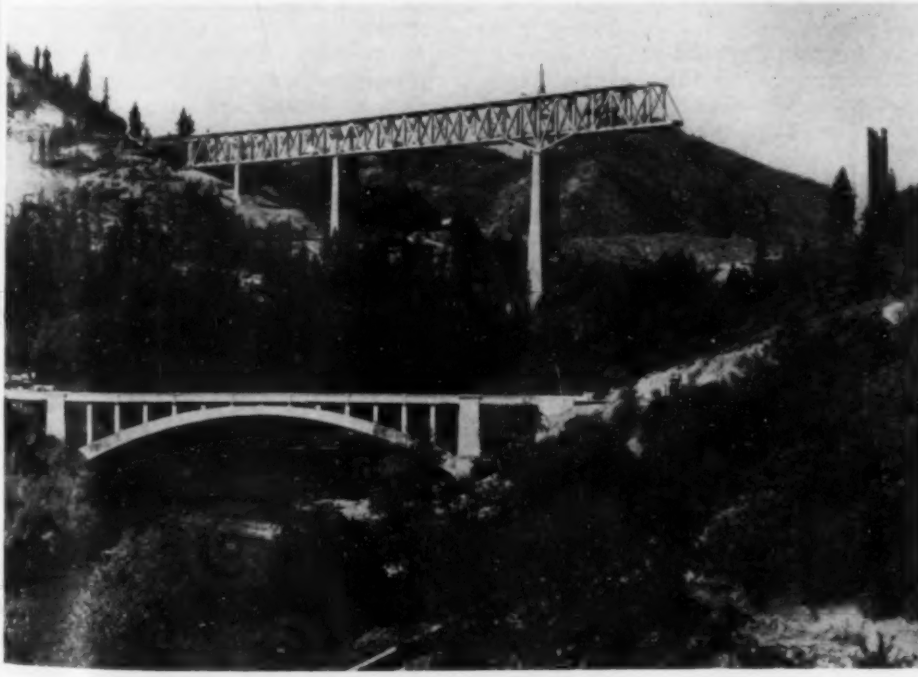
Principal feature of the Central Valley Project in California is Shasta Dam, now being constructed by the U.S. Bureau of Reclamation. The dam, located on the Sacramento River, about ten miles northwest of Redding, will back the water up the Sacramento, Pit, and McCloud rivers from 25 to 40 miles. Previous articles in Civil Engineering have covered such major features of the project as the dam itself, the railroad relocation, and the Pit River Bridge.

The Pacific Highway, or U.S. 99, is the principal north and south interstate highway in California and is a link in the proposed international highway from Alaska to South America. It is of great importance from a military point of view and during the summer of 1941 was used to a considerable extent for troop movements. From Bass Hill about 12 miles north of Redding, the highway traverses the canyons of the Pit, McCloud, and Sacramento rivers for about fifty miles. The flooding of these canyons requires the relocation of about 18 miles of the existing highway as well as some 30 miles of the Southern Pacific Railroad. Of the total mileage of highway to be relocated, 15.5 miles was made necessary by the reservoir and 2.5 miles by conflict of the railroad relocation with the existing highway.

Design standards set up to govern the location took into consideration the importance of the route, the character and volume of traffic to be served, the standards of the road to be replaced, and the limitations imposed by the very steep and broken hillsides along which the highway was to be built. In selecting the design standards for a two-lane highway, where the almost continuous curvature would preclude the possibility of obtaining the length of sight distance that would permit a free flow of traffic, consideration had to be given to how to provide for future increases in volume.

Present traffic has a daily peak of 3,000 and an average daily volume of 2,300 vehicles, of which 10% are trucks. Most of these latter are heavily loaded and slow moving, generally with trailers. On steep grades they travel as slowly as 6 miles an hour and therefore constitute a serious obstruction to traffic on a two-lane road. Some relief was possible for the present traffic movement by providing at intervals straight or open stretches where the accumulations that occur behind slow-moving vehicles can be cleared. Since it will never be practicable to provide over much of the route the sight distance required for the passing of fast-moving vehicles, future modification to take care of increased volume will have to be by the provision of additional lanes.

With all these things in mind, the following standards were adopted. The minimum radius of curvature is 700 ft on open, and 800 ft on blind curves. The traffic lane width is 11 ft and the gross width of the graded roadbed is 32 ft. In cuts, side drainage ditches are 1.5 ft deep, with flat slopes adjacent to the shoulder; on fills, berms and spillway culverts have been provided. Cut slopes are between $^3/_4$ on 1 and $1^3/_4$ on 1, with some compounding and some benching. Fill slopes are $1^1/_2$ on 1, with benching on the higher fills.



New and Old Pit River Bridges

To insure stability of the roadbed, all fills are compacted to predetermined standards and the upper foot of the grade is constructed of selected material of high supporting value. On this, subgrade surfacing will consist of 6 in. of graded crushed rock, specified as crusher run base, spread the entire width of the roadbed. The central 22 ft will be surfaced with a plant mix consisting of graded crushed rock and medium penetration as-

phalt. On this will be a surface application of medium screenings plant-mixed with asphalt and spread at the rate of 55 lb per sq yd. Shoulders 5 ft wide will be constructed of plant mix similar to that used for the roadway. The bituminous mixes for the roadway will be spread, leveled, and compacted with self-propelled mechanical spreaders.

Through the subway under the Southern Pacific Railroad and across an adjoining flat with a high water table, portland cement concrete pavement will be constructed. This section will be of the four-lane divided type with the outer lane 11 ft wide, the inner 12 ft, and both 9 in.-7 in.-9 in. thick.

FOUR-LANE HIGHWAY BRIDGE CROSSES PIT RIVER AT ANTLER, CALIF.

Beginning many years ago with the first conception of the Central Valley Project, preliminary studies included investigations for the rerouting of the highway above the flood level of the reservoir. These studies, which were necessarily in the nature of a reconnaissance, determined several possible routings depending on the height finally selected for the dam. In 1935 the Division of Highways began preliminary surveys for the selection of a route. It was apparent from the start that to clear the elevation of 1,065 selected for the dam, any routing would necessarily be in a forbidding territory through which no one would have the temerity to locate a highway by choice.

The major control and the largest single construction item in the relocation of both highway and railroad was the bridge across the Pit River. The water with the reservoir full would be 400 ft deep at the crossing. Since the bridge would have to be about 3,500 ft long, the economy of carrying the highway and the railroad on a single structure was obvious. Alinement requirements of both highway and railroad fixed the location within narrow limits. Geologists reported that the site which best met the alinement requirements was suitable from a geological standpoint. Subsequent diamond-drill borings revealed that sound rock suitable for under-water foundations of the massive piers occurred at reasonable depths below the surface.

With the bridge site fixed, it was possible to proceed with the location for the highway. Only half a mile of relocation was necessary south of the bridge and no problems were involved.

North of the bridge there were two possible routes. One was to follow the shore line as closely as practicable and the other to climb up into easier country. The contour of the shore line was very irregular, the slopes were very steep, and the stability of some of the hillsides after saturation was questionable. The first investigations demonstrated that even with substandard alinement, many fills on 29° slopes would extend for 250 ft, and when these were below high water, special slope protection would be required. It was soon demonstrated that any routing along the shore line was out of the question.

A rather free use of the 6% maximum grade, with the introduction of three summits, took the location into comparatively easier country, kept the fills out of the reservoir area, permitted better alinement, and resulted in a considerable saving in distance and cost. The final location was 15.5 miles in length. Included in this length are the Pit River Bridge 3,587 ft long, a side-hill bridge over a railroad tunnel portal 377 ft long, and the Antler Bridge over the Sacramento River, 1,330 ft long. There are four crossings of the relocated railroad, three over tunnels, and one by means of an underpass located just north of the Antler Bridge.

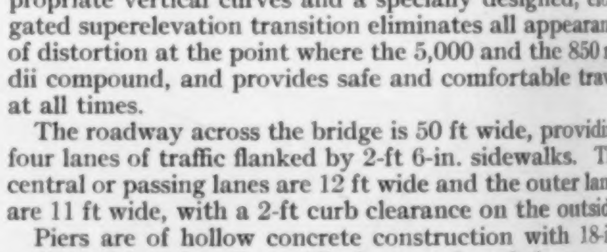
About three miles from the Pit River Bridge, the new highway crosses the old one at a saddle known as O'Brien Summit. For the remainder of the distance the route follows closely that of the first road ever built for traffic through the mountains, known as the old "emigrant road."

There are three major structures involved in the highway relocation. The largest of course is the joint railroad and highway bridge across the Pit River. This bridge, construction of which is now well along, was fully described by Roy M. Snell in the September 1941 issue of CIVIL ENGINEERING. The upper deck has a 44-ft roadway, providing four 10-ft lanes, with 2-ft 6-in. sidewalks on each side. Departure from the railroad, which occupies the lower deck, is easily made on the south end by a light curve in the highway alinement and construction of the abutment over the portal of the railroad tunnel. On the north end, curved alinement permits quick separation of the lines, the highway being carried to the right by a separate viaduct.

Second in size is the bridge across the Sacramento River at Antler, built by contract awarded by the Division of Highways. The bridge is 1,330 ft long and is constructed on a 3.6% grade and on a curve of 5,000-ft radius compounded to an 850-ft radius about 80 ft from the south end. The high point on the bridge is 200 ft above present low water in the river and 80 ft above reservoir high water. A slight crown provided by appropriate vertical curves and a specially designed, elongated superelevation transition eliminates all appearance of distortion at the point where the 5,000 and the 850 radii compound, and provides safe and comfortable travel at all times.

The roadway across the bridge is 50 ft wide, providing four lanes of traffic flanked by 2-ft 6-in. sidewalks. The central or passing lanes are 12 ft wide and the outer lanes are 11 ft wide, with a 2-ft curb clearance on the outside.

Piers are of hollow concrete construction with 18-in. walls and interior ribs. All piers are founded on rock, which is generally a hard andesite. The superstructure consists of a central span of 273 ft, two spans of 252 ft,



BRIDGE AT ANTLER OVER SACRAMENTO RIVER IS 1,330 FT LONG

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Large Cuts 28-Cu Yd Scrapers Pulled by Caterpillar-Tread Tractors Proved Economical

Fills Being Removed by 20 and 28-Cu Yd Scrapers While Bulldozers Trim Slopes

Crosses Over Tunnel Portal—Note Conduit Over Railway Below

Tractors and Scrapers Do Heavy Grading on Steep Slopes

Side-Hill Viaduct, on Curve of 700-Ft Radius

Many Pieces of Equipment Expedited Large Cuts and Fills

Highway Grade Bears No Resemblance to Old "Emigrant Trail"

HEAVY GRADING OPERATIONS FOR THE HIGHWAY WERE CARRIED OUT WITH 28-CU YD SCRAPERS WHILE SHEEPSFOOT ROLLERS CONSOLIDATED FILLS

two of 189 ft, and cantilever end spans of 42 ft supporting suspended spans of 40 and 52 ft, respectively. The two lines of steel deck trusses are 31 ft apart and support floor beams at each 21-ft panel point. There are 9 lines of steel stringers and a reinforced concrete roadway slab $7^1/_4$ in. thick. Main trusses are pin connected to the tops of all piers. The suspended span in the central 273-ft span provides for expansion at one end and divides the bridge into a symmetrical truss layout over the three supports on each side of this span.

Since the bridge is entirely on a curve, the trusses were bent horizontally between each pier. This reduces the eccentricity or overhang of the deck stringers relative to the truss and reduces the steel required for floor beams. Owing to the continuity of the truss and the location of these bend lines at the quarter points, the bending moment in the truss is very low. Torsional stresses are not high enough to require additional metal to resist them.

Use of newly developed alloy steel with 50% greater tensile strength resulted in much saving in weight. Truss members all consist of beam or channel sections. There are no stay plates or lacing bars. This feature of the design eliminates metal not required to resist stress, reduces shop fabrication costs and initial and future painting cost.

The third structure is a reinforced concrete bridge across the face of a steep cliff above the portal of one of the railroad tunnels. This bridge is 377 ft long and 37 ft wide, providing three 11-ft traffic lanes. It was constructed as a part of one of the grading contracts.

Two lesser structures are required. One is a subway under the relocated Southern Pacific Railroad just north of the Antler Bridge. This provides two 28-ft openings with a 9-ft dividing strip at the center pier. The structure consists of two 42-ft 6-in. through girder spans with concrete abutments and steel columns on concrete footings for the center support. By means of an outlet channel cut through rock, the surface and subdrainage of the subway basin are removed. The other minor structure is the Salt Creek arch. This is a concrete arch with a width of 16 ft and a height of 20 ft. It is 182 ft long and has a fill of 42 ft over it.

The northerly 2.53 miles of the relocation was made necessary by the conflict of the railroad relocation with the existing highway rather than by the water level of the reservoir. By reason of this conflict, and to avoid confusion in timing between contractors, the grading and surfacing of this unit was included with the grading of the conflicting unit of the railroad in a contract let by the Bureau of Reclamation in 1939. This unit complete cost $62,000 per mile. The remainder of the grading has been completed in two contracts awarded and supervised by the California Division of Highways.

The first contract to be awarded by the state was for grading 4.08 miles between Bass Hill, about one-half mile south of the Pit River Bridge, and O'Brien Summit. Work was started late in 1939. This unit contains some of the heaviest grading ever undertaken on two-lane construction in northern California. A total of 1,520,000 cu yd of excavation was involved. One mile of this section required the removal of 655,000 cu yd. The upper slope stake of the benched cut is 268 ft above grade. The lower slope stake of the adjacent fill is 280 ft below grade.

Early in 1940 the second contract for grading the remaining 8.31 miles was awarded by the Division of Highways. A total of 1,350,000 cu yd of excavation was required on this unit.

Geologically speaking, the area through which the new highway is being built is in the Mississippian series of the Carboniferous system. These shale deposits were uplifted and altered by the heat of the intrusive diabase batholiths. This altered shale is weathered to considerable depths and some of the weathered areas are unstable. In general this shale occurs in thin bedded planes and is quite hard, although it is readily loosened with heavy scarifying equipment. In two cuts on the project the dip of the strata required the slopes to be flattened to $1^1/_4$ on 1 and $1^3/_4$ on 1, respectively. The nature of the formation was ideal for grading with tractor and scraper units. There was one power shovel on the job for handling a few of the rocky deposits; otherwise all the excavating was done with caterpillar-tread tractors and rubber-tired scrapers with capacities from 18 to 30 cu yd.

In the areas where the shale was weathered to appreciable depths, cut slopes were benched or compounded. Embankments were built in horizontal layers and were watered and compacted with sheepsfoot rollers.

The approximate cost of the two grading jobs now nearing completion is $910,000. Bids for the surfacing contract were opened on October 22, 1941. The type of surfacing has already been described. The schedule for construction of Shasta Dam contemplates flooding parts of the old highway about midsummer of 1942. The Pit River Bridge will be completed early in 1942, and the highway surfacing contract is being timed to be completed before the old highway is flooded.

The highway and construction work was carried out under the direction of C. H. Purcell, State Highway Engineer, and is subject to approval by Ralph Lowry, Construction Engineer for the Bureau of Reclamation. The Sacramento River bridge at Antler was designed under the direction of F. W. Panhorst, Bridge Engineer for the Division of Highways. All are Society members.

Escondido Ditch Carries Over 70 Cu Ft per Sec Through Rough Terrain with Small Losses
Owned by Escondido Mutual Water Company and San Diego County Water Company

Distinctive Features of the Irrigation Systems in San Diego County, Calif.

By Fred D. Pyle, M. Am. Soc. C.E.
Hydraulic Engineer for the City of San Diego, Calif.

San Diego County, with an average rainfall of under 10 in. along the coast, and a rapid increase in population, examines with renewed interest its water supply. After briefly describing the sources, quality, and storage capacities, Mr. Pyle outlines the distinctive features of the county's water problems. Of special interest is the distribution of water between homes, estates, and small farms with surprisingly little loss. This paper was originally delivered before the Irrigation Division at the Society's San Diego Convention in July.

The irrigation systems of San Diego County comprise seven irrigation districts, five mutual water companies, and four water companies, of which only one is a public utility. In addition, many individual farmers operate their own irrigation systems, securing the water from wells generally located on their own land. Some water is also furnished for irrigation by the Indian Service and by the cities of San Diego and Oceanside. About 28,000 acres are irrigated with water furnished by the larger agencies and about 25,000 acres by individual pumping plants, making a total of about 53,000 acres, of which a considerable portion, perhaps 15,000 acres, has a somewhat inadequate supply for meeting long drought periods.

Available Water Supplies

As there are no streams or springs of consequence in the area that run longer than from December to May of wet years, or more than thirty days during dry seasons, irrigation depends on storage reservoirs and underground sources. The annual rainfall at San Diego has averaged 9.75 in. for the past 85 years, with an increase of about 6 in. per 1,000 ft in elevation on the Pacific slope. The precipitation on the Salton Sea slope is negligible, and irrigation is confined to the Pacific slope. The runoff varies greatly, but the records for the past 58 years indicate a large runoff at 11-year periods—1883, 1905, 1916, 1927, 1937—with some extra runoff in 1922, 1938, 1939, 1940, and 1941. The longest drought during this period was from 1897 to 1904, when there was practically no runoff.

Fortunately there are a number of reservoir sites where water can be stored by the construction of rather expensive dams. The larger and more dependable underground basins are found in the valley floors, of which there are 9 ranging in width from $^1/_2$ to 1 mile and in length from 3 to 6 miles, and having a depth of sand and fine gravel of 100 to 150 ft. A small amount of water is sometimes found near the bottom of the alluvial fill in upland valleys, and occasionally small supplies are secured from deep wells—200 to 800 ft. A few deep test wells for oil have found some water but not sufficient to justify the installation of costly deep wells for water.

Except for, and subject to, the paramount right of the City of San Diego to all the waters of the San Diego River from the utmost limits of the drainage basin to the ocean, surface and subsurface, when the city has need for it, the water users depend on appropriative rights for water stored in reservoirs and on riparian rights for water taken from wells. There are only a few minor diversions from streams, generally individually owned. A number of irrigation districts and water delivery agencies obtain their supply by purchase contracts from owners of large conservation reservoirs. These contracts are as nearly perpetual as it is possible to make them.

The chemical quality of the water is excellent, although the underground water contains from 2 to 5 times as much dissolved mineral as the flood waters stored in reservoirs. (The hardness of reservoir water, in terms of $CaCO_3$, is 100 to 125 ppm, and that of underground water, 200 to 500 ppm.) As much of the water delivered by agencies furnishing water for irrigation is also used for domestic purposes, these agencies treat the

Gunite Flume, Vista Irrigation District, Prevents Water Losses

CONCRETE STANDBY RESERVOIR, VISTA IRRIGATION DISTRICT

water in reservoirs with copper sulfate for control of algae and apply chlorine in pipe lines or conduits for control of bacteria.

The safe yield of a reservoir development for domestic purposes is the amount of water it can deliver each year through a drought period such as occurred from 1897 to 1904. The safe yield is considerably greater for irrigation use, where there can be some loss of annual crops from time to time but a minimum of loss of commercial orchard trees. The duty of water from underground sources cannot be determined very definitely.

About one-half of the water resources of the county are developed; of the amount developed, about one-half is used by cities and towns and the other half by agricultural areas. Of the water supplied to agricultural areas, about 20% is used for domestic purposes. The area of lands capable of producing oranges, lemons, avocados, grapes, and semi-tropical fruits is greatly in excess of the local water supply even when fully developed. The favorable climatic conditions and the suitability of the area for national defense projects make it necessary to look to the Colorado River for a standby supply and ultimately for regular use. The City of San Diego has a right to Colorado River water for the use of the city and county to the extent of 112,000 acre-ft per annum. Water conservation works as now constructed for the Cottonwood-Otay Sweetwater, San Diego, and San Dieguito watersheds have a safe yield of about 45,000 acre-ft per annum, and when these resources are fully conserved, the safe yield will be about 90,000 acre-ft. These watersheds represent about two-thirds of the run-off of the county. The remaining one-third is less than one-third developed. As storage reservoirs are provided, the area depending on individually developed underground sources decreases.

STEEL PIPES ABOUT TO BE PROTECTED BY CONCRETE CASING, VISTA IRRIGATION DISTRICT
Forms in Place for Air-Pressure Placing of Concrete

Where economically practicable, large holdover capacity is provided in reservoirs in order to make water available through drought periods. In general the evaporation losses from the reservoirs over a long period of time will about equal the diversions.

Water is carried generally in concrete or steel pipes, concrete-lined conduits, and concrete or gunite bench flumes. There are no open unlined canals. Underground water is of necessity pumped. Some of the water is pumped against heads as high as 300 ft.

Most of the irrigated land is served in tracts of 1 to 20 acres and only a small number of the tracts contain over 40 acres. The average size of the tracts served is 5 acres. Many of the tracts to which water is served vary in size from the ordinary 50-by-150 building lot to an acre. Roughly, about half of the land using irrigation water consists of homes and estates rather than of irrigated farms operated for profit. About 80% of the population of the irrigated lands, or served by agencies delivering water for irrigation, is not engaged in irrigation agriculture.

COMPRESSED-AIR EQUIPMENT BEING USED TO ENCASE STEEL PIPE WITH CONCRETE

The cost of water for irrigation delivered to the user varies from about $5 per acre-ft for shallow wells to $30 per acre-ft for the larger agencies. Several irrigation districts deliver water principally for domestic use. The high cost of water is due to the type of construction required to conserve and transport the water and to the small units of delivery. The cost of water to the user is generally divided into two parts, a rate per acre-foot for water delivered and an assessment on land in the case of irrigation districts, or on stock in the case of mutual water companies. Public utility rates include all costs and profit.

A very large portion of the water is delivered under pressure through standard meters. For small tracts, generally up to 2 or 3 acres, the users draw water as they desire, while for larger tracts, very few of which exceed 40 acres, they must apply for the water 24 hours or more in advance of use. Many of the users, especially for tracts in excess of 2 acres, have two meters, a small one for domestic use through which water may be drawn at any time, and a larger one for irrigation use. The charges for water taken through the domestic meters are generally much greater than for that drawn through the irrigation meters. Some receive water through

combination meters at charges on a sliding scale. Because of the amount of water used for domestic purposes and because some water is required for irrigation every month of the year except in the very wettest seasons, the irrigation systems are in operation throughout the year.

On account of the high cost of water and the small size of tracts, water is generally applied by the furrow method. Some is applied by sprinklers, but practically none is applied by the flooding method. The duty of water averages about 1.4 acre-ft per year for irrigated land. One acre-ft of water per year is sufficient to supply 7.1 people with domestic water, including that for lawns, gardens, and industrial use. In terms of million gallons a day, 1 mgd of safe yield is sufficient for 8,000 people or 800 acres of irrigated land.

DATA BEARING ON WATER SUPPLY PROBLEM

The following data have been taken from the annual report of the Vista Irrigation District for 1940 and illustrate many features of irrigation in San Diego County.

The District was organized in 1924 and the principal works were completed, and the first water delivered, in the spring of 1926. It has within its boundaries 16,772 acres, of which 12,390 are entitled to water and 4,382 have waived the right to water. The assessed valuation of the land entitled to water is $1,942,496, or an average of $156.79 per acre; that of the land not entitled to water is $26,448, or an average of only $6.04 per acre.

On December 1, 1940, the irrigated area of the District totaled 7,020 acres, of which 5,883 were in trees and nursery and 1,137 in field crops. The principal orchard crops were avocados, 3,184 acres; oranges, 1,465 acres; lemons, 777 acres; limes, 202 acres; and grapefruit, 103 acres. The principal field crops were tomatoes, 300 acres; peas, 200 acres; string beans, 200 acres; and bulbs, 130 acres. Only 5 acres were in alfalfa.

HODGES DAM, SOURCE OF WATER SUPPLY FOR SANTA FE IRRIGATION DISTRICT, SAN DIEGUITO IRRIGATION DISTRICT, DEL MAR WATER, LIGHT AND POWER COMPANY, AND CITY OF SAN DIEGO

There were 1,403 homes and the population was 3,755 compared with 631 homes and a population of 2,636 on December 31, 1932. School enrollment was 623 as compared with 446 in 1932.

The District's principal works consist of a main conduit, with a capacity of 44 cu ft per sec, made up of 1.89 miles of 42-in. concrete pipe, 3.56 miles of 36-in. steel siphons, 6.70 miles of concrete gunite flume, and 0.39 miles of tunnel. At the lower end of the conduit there is a standby reservoir with a capacity of 200 acre-ft. The distribution system consists of 23.46 miles of 8 to 36-in. concrete gravity pipe, 26.07 miles of 8 to 36-in. concrete pressure pipe, 112.66 miles of 4 to 26-in. steel pressure pipe, 7.50 miles of 10 to 14-in. pressure reinforced

OLD WOODEN FLUMES IN LA MESA, LEMON GROVE, AND SPRING VALLEY IRRIGATION DISTRICT ARE REPLACED WITH 42-IN. REINFORCED CONCRETE PIPE

concrete and steel pipe, and 8 pressure regulating reservoirs having capacities of 30,000 to 175,000 cu ft.

Owing to the corrosive action of the soil, much of the steel pipe has been repaired or replaced during the past 5 years. The District management has developed a very ingenious method of placing concrete by pressure around thoroughly cleaned steel pipe in place. This concrete is amply reinforced and the pipe is probably as lasting as reinforced concrete pipe. New steel pipe and reconditioned pipe is lined in the District's yard with spun cement lining after sandblasting.

Water purchased in 1940 from the San Diego County Water Company, owners of Henshaw Reservoir, totaled 8,441.28 acre-ft, which, at $17.50 per acre, comes to $147,722.40. Water sold totaled 7,969.38 acre-ft; the price was 4 cents per 100 cu ft for irrigation use, 5 cents per 100 cu ft for domestic use, and 5 cents per 100 cu ft for combination irrigation and domestic use, with certain fixed meter and minimum charges. The income from water sales was $147,316.94. Losses in acre-feet were 5.59%, which compares favorably with any city system. All water is metered. On December 31, 1940, there were 276 domestic, 235 combination, and 1,404 irrigation meters, or a total of 1,915 meters in service.

Average use of water is 1.13 acre-ft per acre of crop meter measurement; 20 typical groves containing 199 acres used an average of 1.51, 1.52, and 1.49 acre-ft of water in 1938, 1939, and 1940, respectively. The average assessment per acre for maintenance, operation, bond interest, and bond redemption was $8.58, $7.83, $7.83, $7.05, and $7.06 for the years 1937, 1938, 1939, 1940, and 1941, respectively.

With the aid of the Reconstruction Finance Corporation in 1935, the original bonded indebtedness of $1,700,000 in 6% was refinanced on the basis of $937,500 in 4% bonds. Gross receipts in 1940 were $290,182.47, gross expenditures, $272,079.62. Cash on hand on December 31, 1940, was $179,245.34, an increase of $18,102.85 over December 31, 1939.

The distinctive features of the irrigation systems in San Diego County are: (1) the long-time storage required, (2) use of lined conduits and pipe for carrying all water, (3) the small size of the tracts served, (4) the preponderant use of irrigated lands for homes and estates rather than for agriculture, (5) high cost of water, (6) extensive use of standard meters, (7) extremely long delivery seasons, and (8) application of water by furrows and sprinkling.

Theodore Dehone Judah—Railroad Pioneer

Part II. Surmounting the Sierra Nevada

By John D. Galloway, Hon. M. Am. Soc. C.E.
Consulting Engineer, Berkeley, Calif.

PROVIDENCE, it is said, develops great men to meet great emergencies. Judah was such a man. Against the most stupendous problem of early western railroading, the hurdling of the rugged Sierras, he pitted heroic qualities—youth, energy, aggressiveness, persistence, and determination, buttressed with sound engineering judgment. In his fight against tremendous odds, he needed them all. By the verdict of his contemporaries and by the test of the years he was eminently successful, as Mr. Galloway graphically shows. This article completes the remarkable story begun in the October issue.

BUILDING of the Central Pacific Railroad, starting from tidewater on the Pacific to complete the first transcontinental line, easily ranks as one of the most important if not the greatest engineering exploit of the early West. It was largely the work of one man, Theodore Dehone Judah. Trained in the East, he had built the 22-mile Sacramento Railroad in California before he was 30 years old. During this time he was obsessed with the ambition to conquer the Sierra crossing. This longing, which seemed fantastic to his friends, possessed his mind continuously. Some of the details of his ambitious dreams were given in the article in the October issue.

By 1859 Judah had attended three sessions of Congress with the aim of furthering the Pacific Railroad Project. The results of the Government surveys had become known, and the agitation for the railroad was growing in strength. The Government reports, while complete, could not of themselves produce a railroad. Congress could not agree upon a route, and was absorbed by the problems that culminated in a few years in the Civil War. On January 1, 1857, Judah published in Washington a pamphlet entitled "A Practical Plan for Building the Pacific Railroad," in which he outlined the substance of a project to be built by private enterprise without Government aid. He felt that the national Government was "a house divided against itself"; that the project could not be undertaken "until the route is defined; and if defined, the opposing interest is powerful enough to defeat it."

His estimate of the general situation was correct. He maintained that what was required was a definite survey on a selected route and not general reconnaissances of several routes, on which differences of opinion would certainly arise. He stated that about $200,000 was required for surveys and that the project for the 2,000 miles of road would average about $75,000 per mile, or a total of $150,000,000.

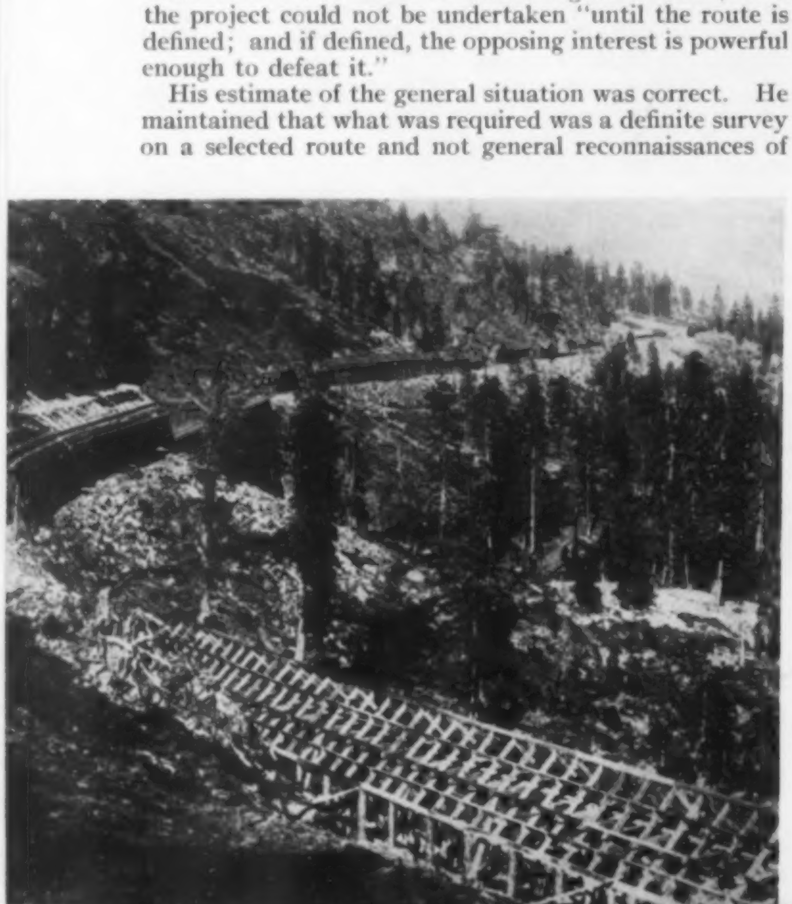
Congress did nothing. So Judah returned to Sacramento, convinced that the Pacific Railroad must be promoted from the West. Probably under his inspiration, the California State Legislature on April 5, 1859, passed a resolution calling for a convention to consider the subject. Over one hundred delegates met in San Francisco on September 20, 1859, with Judah as a representative from Sacramento. As usual, debate centered on the route to be adopted, and a resolution was passed expressing preference for the Central Railroad route. A number of ideas were discussed by the convention. In all the actions taken, Judah had a prominent part. In the end, on October 11, 1859, he was formally appointed as the accredited agent of the convention to convey its recommendations to Washington. Judah sailed on October 20, 1859.

Although Judah established an office in the Capitol, filled with maps and other data for the enlightenment of Congress, the necessary bills never reached a vote. His work, however, had laid a foundation for the later bills, passed in 1862.

While Judah was in the East, he took pains to accumulate the latest information on railroads that might be useful in the Western venture. Several lines across the Appalachian Mountains, notably the Baltimore and Ohio, were fine examples of this type of construction. He returned to California convinced that nothing could be done in Congress until an actual project was outlined, with proper surveys, estimates, and organization.

In 1860 Judah was in the mountains, making a reconnaissance of several routes, using a barometer to determine elevations. Dr. Daniel W. Strong, a druggist of Dutch Flat, Calif., had heard of the explorations of Judah and invited him to come to Dutch Flat and examine the Donner Pass route. When Judah reached Dutch Flat he formed a friendship with Strong that lasted the rest of his life. This route had been traveled by some of the early emigrants, who came up the Truckee River and crossed the divide. Mostly, however, they used more favorable wagon roads to the north and south. By this time the tide of immigration had turned eastward to the mines of Nevada, and Dr. Strong, with others, was interested in a possible wagon route over Donner Pass to divert traffic through his home town.

It is hardly necessary to argue as to who deserves the honor for determining the route of the railroad over the Sierra Nevada. Dr. Strong undoubtedly is entitled to the credit for suggesting a route that had been known



Early Snowshed Construction Near Cisco, Calif.

Howe Truss Bridge, Lower Cascade, Central Pacific Railroad
Used as a Symbol in the Judah Monument at Sacramento

for over ten years as an emigrant trail. However, it required the trained eye of a practical engineer to determine in a preliminary way the merits of the location that was afterward adopted. The two men went over the route across the mountains in the fall of 1860, and on their return Judah prepared the engineering data at Dr. Strong's store in Dutch Flat. It was agreed that a corporation should be formed and articles were written with that end in view. Judah prepared a pamphlet entitled "Central Pacific Railroad of California," published in San Francisco in November 1860, in which he advocated the chosen route, as the most practicable one, "which gives nearly a direct line to Washoe with maximum grades of one hundred feet per mile. The elevation of the Pass is 6,690 ft." Washoe was the name then applied to the Virginia City–Gold Hill developments in Nevada. One point made by Judah was that the proposed route was shorter by possibly 150 miles than that recommended in the Government reports. He also dwelt upon the possibilities of traffic with the Nevada mines and estimated the resulting revenue from it. Government aid was contemplated.

Dr. Strong secured subscriptions amounting to $46,500 and Judah went to San Francisco to secure the remainder, some $70,000. While he was well received at first, when the time came for subscriptions, none of those approached were willing to sign their names. Judah, who was called an enthusiastic lunatic, went back to Sacramento, disgusted with San Francisco. A meeting in Sacramento, the first of several, was well attended. At later meetings, Judah for the first time met the men who were to carry out the project—Leland Stanford, Collis P. Huntington, Mark Hopkins, and Charles Crocker. Huntington was cautious and only agreed to share the cost of the surveys; after those were made, he would consider the subject further.

As a result of Judah's efforts, an organization meeting of stockholders was held on April 30, 1861, and on June 28, the Central Pacific Railroad of California was incorporated. Leland Stanford, just nominated for governor on the Republican ticket, was made president. Huntington became vice-president, Hopkins, secretary, and Judah, chief engineer. Strong was a director.

This organization gave Judah the necessary money for surveys, and he soon organized field parties. A barometric reconnaissance was also made of two other possible routes, both of which proved markedly inferior to that proposed. The results were embodied in a report by Judah dated October 1, 1861, in which the merits of the route were discussed and the benefits from Government assistance were set forth. The cost from Sacramento to the state line was estimated at $12,380,000, and costs to several other more distant points as far as Salt Lake City were also estimated, the total for 733 miles to that point being $41,415,000. Judah's route resulted in saving a distance of 184 miles over the Government route and, in his own words, in "developing a line with lighter grades, less distance and encountering fewer obstacles than found upon any other route or line hitherto examined across the Sierra Nevada Mountains."

Referring to the engineering problem of location he explained:

"When it is considered that the average length of the western slope of the Sierra Nevada Mountains, from summit to base, is only about 70 miles and the general height of its lowest passes about 7,000 ft, the difficulty of locating a railroad line with 100-ft grades is correspondingly increased, as it becomes absolutely necessary to find ground upon which to preserve a general uniformity of grade.

"In the present instance, the elevation of the summit... is reached by maximum grade of 105 ft per mile; showing a remarkable regularity of surface, without which the ascent could not have been accomplished with this grade."

In describing the ridge up which the road was located, he said:

"These rivers run through gorges or canyons, in many places from 1,000 to 2,000 ft in depth, with side slopes varying from perpendicular to an angle of forty-five degrees. The ridges formed by these rivers are sharp, well defined, and in many places so narrow on top as to leave barely room for a wagon road to be made without excavating surface of ridge. The branches, also, of many of these rivers have worn out gorges as deep as those of the rivers, and present physical barriers to a line of communication either crossing them or extending in a northerly and southerly direction. The line on top or crest of ridge being far from uniform, of course the lowest points or gaps in ridge become commanding points, and it was found necessary to carry the line from gap to gap, passing around the intervening hills, upon their side slopes."

The controlling gaps that were of the most importance were Clipper Gap, 42 miles from Sacramento; New England Gap, 6 miles farther; Long Ravine, about 4 miles from Illinoistown (Colfax); and Emigrant Gap, 82 miles from Sacramento. Beyond this the line, as finally located, was on the side of a mountain and the gaps no longer controlled the surveys.

Following the report in October 1861, the directors authorized Judah "to... proceed to Washington... as

Excavation in the Sixties
With the Aid of One-Horse Dump Carts, Black Powder, and Chinese Coolie Labor

MEETING THE TRAIN AT CISCO, CALIF., IN 1865
Concord-Type Horse-Drawn Coaches Served Temporary Eastern Terminus of the Prospective Transcontinental Railroad

the accredited agent of the...Railroad, for the purpose of procuring appropriations of land and U.S. Bonds from the Government to aid in the construction of this road."

Upon his arrival he began an active campaign for the bill for a Pacific Railroad. Through Senator Sargent of California, a subcommittee of the Pacific Railroad Committee was appointed to draft the bill. Judah had obtained the appointment as secretary of the Senate Committee and was also made clerk of a subcommittee in the House. Finally, on July 1, 1862, the bill became a law with President Lincoln's signature. Lands, rights of way, and aid in the form of first-mortgage Government bonds were the essential elements of the bill, which also provided for the organization of the Union Pacific Railroad Company. Bonds were to be issued when 40 miles of railroad had been constructed.

CONTRACT WITH THE GOVERNMENT FINALLY SIGNED

After some preliminary items had been adjusted, Judah went to New York to order supplies. Formal acceptance of the contract between the Government and the Central Pacific Railroad Company was signed November 1, 1862. Judah sailed for California the 21st of July, his long struggle for the railroad completed. His success was largely due to his own efforts, without money or influence.

On his return to Sacramento, he filed his second report with the company, dated October 22, 1862. He enumerated the advantages of the arrangement with the Government, the value of the land grants, the amount of lumber available, and the anticipated revenue, largely from local traffic and the traffic with Washoe. His estimates, based on actual count of freight and passenger traffic on the American River route, may have been overly optimistic, but they showed that a good business existed. One point may be mentioned that was of importance in expanding the ideas of his associates: the act of 1862 permitted the California company to build eastward until it met the Union Pacific Railroad and Judah urged the company to promptly extend its surveys as far as Salt Lake. The road was rapidly taking on the character of a transcontinental line, with the greater cost and larger outlook.

Construction started on January 8, 1863, when ground was broken at Sacramento. In the later months of 1862, surveys had been pushed by several parties in the mountains. In December, Charles Crocker was given a contract for grading the first 31 miles to Newcastle, subcontractors taking short sections of the line.

In another report, dated June 1, 1863, Judah, as chief engineer, further described in detail some of the engineering problems. Again, in July, he made what was to be his last report to the directors. In addition to the account of the surveys, there was an estimate of the cost of the first 50 miles. He explained why the Sacramento Valley Railroad could not be incorporated in the new line—it was not in the proper location, being eight miles longer to Auburn; the Government bill applied only to a new road; the older road was heavily bonded and hence the Government bonds would not be available; the worn rails of English make would have to be replaced with American iron and much repair work would be necessary; and finally it did not command the possible traffic from the northern section of the state. The decision was correct, but much criticism was directed against Judah by the owners of the older road, who wanted to sell out.

Meanwhile, differences of opinion had developed between Judah and the men who were directing the affairs of the company—Stanford, Huntington, Hopkins, and Crocker. Most of the other directors had dropped out. Judah became impatient and expressed himself in a letter dated May 13, 1863, to his friend Strong:

"I cannot tell you in the brief space of a letter all that is going on, or of all that has taken place; suffice to say that I have had a pretty hard row to hoe...I had a blow-out about two weeks ago and freed my mind, so much so that I looked for instant decapitation. I called things by their right name and invited war, but counsels of peace prevailed and my head is still on but my hands are tied, however. We have no meeting of the board nowadays, except the regular monthly meeting, which, however, was not had this month; but there have been any quantity of private conferences to which I have not been invited."

Judah maintained that his stock subscription had been paid for by his previous services but Hopkins ruled otherwise. Huntington returned from the East and evidently was an influence that Judah resented; he objected to exclusive contracts being given to Crocker and in a letter declared that he had prevented a certain gentleman, probably meaning Crocker, from being a contractor on the road. The directors had themselves organized the Dutch Flat and Donner Lake wagon road, which was intended to bring to the railroad much-needed revenue from the Washoe mines. However, it was not a railroad wagon road but one belonging to the four directors, and the revenues, if any, were to be theirs and not the railroad's.

This was but one of many sources of differences between Judah and his friends on one hand and the four directors on the other. Judah was an engineer and wanted to get on with building the railroad. The four directors had before them the problem of financing the road and meeting the continuous attacks made on their enterprise by antagonistic interests. For them there was no use in going on with the construction unless they could control the venture and assure themselves of a substantial profit.

The nature of the men involved in the controversy was an element that made for discord. Judah was a

strong, persistent, and emphatic character. The railroad project was his own, one that he had developed and brought to realization; to have others take charge was a thing he could hardly understand. On the other hand he was dealing with four men equally strong minded who intended to dominate the enterprise if it was carried out. A clash was almost inevitable; it came to a head in the summer of 1863.

While the details are lacking, the result was that Judah was bought out for the sum of $100,000, but at the same time he was given an option to buy out the four associates for an equal amount each. They evidently were in doubt as to the possibilities for profit and were willing to get out for the sum named. They were all merchants and not railroad builders and at that time the Government help, from the nature of the law, was of little or no benefit. Judah decided to go East, and he left in September.

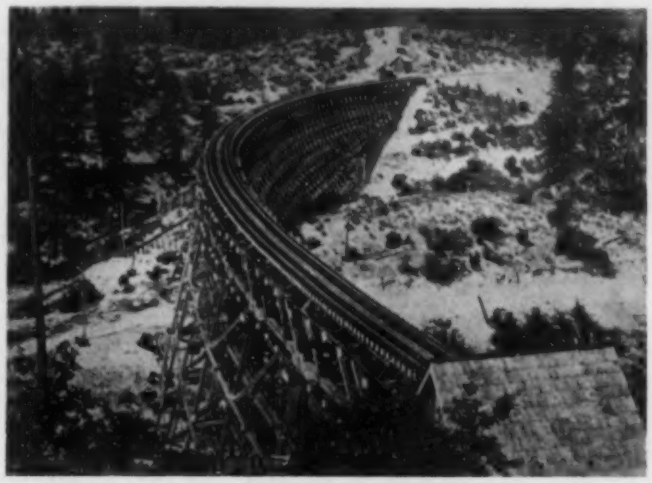
There is evidence that Judah had arranged to meet certain parties in New York and Mrs. Judah later stated that they were the Vanderbilt group, then in control of the New York Central Railroad. He sailed from San Francisco early in October 1863. At the Isthmus he contracted Panama fever, and on November 2, a few days after he reached New York, he died. He was buried at Greenfield, Mass., his wife's girlhood home.

THE END OF A REMARKABLE CAREER

Thus, before he was 38, ended the remarkable career of a man to whom must be given the credit of originating a practicable plan for the Pacific Railroad in California, of selecting the general location of the line, and of organizing a company to prosecute the work. On his death, the enemies of the railroad endeavored to besmirch his character; and none more so than one of the former promoters of the Sacramento Valley Railroad and of a paper project to the Virginia City mines. Pamphlets were written and distributed and the officials of the Central Pacific answered. These pamphlets are of interest now, not with respect to the railroad as built, but as indicating the type of men Judah had to fight—men who would not stop at vilifying even the dead in the hope of defeating the project for which he gave his life.

Much criticism has been directed at the officers of the railroad company for consigning the memory of Judah to oblivion. The board did pass a resolution, "That the death of Mr. Judah, in the prime of his manhood and the full career of his usefulness, will be felt far beyond the immediate circle of his acquaintance. His ability as an engineer, his untiring energy of character, and the success with which he followed his profession, place him among those whose lives are a benefit to the state, and in whose death the public experiences an undoubted calamity." In answer to some of the slanders, President Leland Stanford declared that Judah remained the chief engineer up to the time of his death. It is worthy to note in this connection that in 1862 a testimonial to Judah signed by 35 members of the House and 17 Senators recited his services in assisting the passage of the bill through Congress and especially in preparing the accurate and detailed information he had supplied.

It was but natural that poor Mrs. Judah should see only the part that her dead husband had played and should voice some feeling against the men of the railroad company. In justice to them, however, it must be said that there was nothing they could do. Naming a station or locomotive after the dead engineer would have been futile. It is inevitable that the memory of even exceptional men must pass away, for the living are but little concerned with the dead. However, more than



Secret-Town Bridge and Trestle in the Sierra Nevada
Length, 1,100 Ft; Maximum Height, 95 Ft. Built in 1866–1867

sixty years afterwards, when the new station was built at Sacramento, employees of the engineering and maintenance departments of the company, led by W. H. Kirkbride, M. Am. Soc. C.E., chief engineer, subscribed the money for, and erected on the station grounds, a monument to the first chief engineer of the road.

That Judah was a man of exceptional ability will be apparent from the record of his signal achievements. What would have been developed out of his disagreement with the "Big Four" and the proposed financing by Eastern men must remain in the realm of conjecture. Judah was not the character to occupy a subordinate position and accept the dictates of other men. His friends were warm in their praise of his character and of his work. The slanders of the time were inspired by motives unconnected with the character of the man and they have long since died away.

Outstanding was his clear insight into the proper location of the railroad over a mountain chain far more lofty and rugged than any previously surmounted by a railroad. He analyzed clearly the pros and cons of the chosen route and of other possible routes. While others were talking of a railroad to the state line, Judah saw that the road must be transcontinental. William Hood, who came as a young man to the service of the Central Pacific in 1867 and was for many years chief engineer of the Central and Southern Pacific Railroads, asserted that "were there now no railroad over the Sierra, the Donner Lake route would still be selected over all others as the best possible."

For the more than seventy years that have passed since its completion, traffic of central California and the West has been carried over the Central Pacific. In spite of the fact that eight other transcontinental railroads have been built, the central route retains its preeminence. The railroad was built on the route selected by Judah. That is his monument; none better could be devised for any man.

Those interested in further study may well consult the admirable "Sketch of the Life of Theodore D. Judah" by Carl I. Wheat, in the *Quarterly* of the California Historical Society, September 1925; also the "History of the Southern Pacific Railroad" by Erle Heath and Lindsay Campbell, in the Southern Pacific Bulletin, 1926. The writer has freely drawn on these and on the reports that Judah made from time to time. Material is also found in the works of the historians, Theodore Hittell and Hubert Howe Bancroft.

Electric Power Supply of Pacific Southwest

National Defense Demands Focus Interest on Power Resources in This Rapidly Developing Industrial Area

By Lester S. Ready

Consulting Engineer, San Francisco, Calif.

National defense demands for more and more power indicate the importance of this factor in the present emergency. In both our Southeast and Pacific Southwest, where great industrial expansion is under way, there is an acute shortage of electric power. This review by Mr. Ready, of existing supplies in the states of California, Arizona, and Nevada, with additions now under construction, as compared with the present market, is therefore most timely. His paper was originally delivered before the Power Division at the Society's San Diego Meeting in July.

An adequate supply of electric energy is of major importance to the Pacific Southwest—comprising California, Nevada, and Arizona—where large defense orders have been placed. Contracts representing hundreds of millions of dollars have been awarded to airplane factories in the Los Angeles and San Diego metropolitan areas; in the San Francisco Bay and Los Angeles areas, shipbuilding and naval contracts total approximately one billion dollars. As a result there has been a rapid influx of workers to meet the demand for labor. The requirements of these defense industries represent only a part of the increased demand for power in these areas. Adequate housing of workers, agricultural expansion, and the quickening of industries to meet growing needs of war industries and population are all increasing the demand for electric energy. A satellite chart showing Pacific Coast electric utility interconnections is shown in Fig. 1, which gives both the publicly and privately owned systems thoughout the Pacific Coast and Southwest areas.

The electric power market of the Pacific Southwest may be divided into two major districts: the one, including northern and central California, extends from the Oregon line to Bakersfield—nearly 500 miles—with the major density in the San Francisco Bay area; the other, southern California, has its major concentration in the Los Angeles metropolitan area. There is also a lesser power market in central Arizona, as well as a scattered market in Nevada. The relative size of these markets, measured in annual energy utilization for the year 1940, is approximately as follows:

Northern and Central California..	6,300,000,000 kwhr	46.4%
Southern California............	6,260,000,000 kwhr	46.1%
Arizona........................	800,000,000 kwhr	5.9%
Nevada.........................	220,000,000 kwhr	1.6%
Total..........................	13,580,000,000 kwhr	100.0%

The annual load factor is about 62% in northern and central California and 60% in southern California, making the simultaneous demands approximately 1,200,000 kw in each of these areas.

Most of the electric energy utilized by the two major districts is supplied by hydroelectric plants; steam-electric plants are generally operated to meet peak demands during wet years and to supply deficiencies in capacity and energy output of hydroelectric plants in dry years. In northern and central California the supply of power comes from hydroelectric plants in the Sierra Nevada, extending from Mt. Shasta 450 miles southward to the south end of the San Joaquin Valley; and from steam-electric plants located mainly in the San Francisco Bay area.

The principal sources of the hydroelectric power supplied to southern California are the San Joaquin River in the Sierra Nevada, east of Fresno, and Boulder Dam. Major steam-electric plants are located in the Los Angeles metropolitan area and in the City of San Diego.

Power in central Arizona is supplied from hydroelectric plants installed in connection with reclamation systems and from local steam- and diesel-electric plants. Recently a 160-kv transmission line to Parker Dam on the Colorado River was completed, thus connecting this area to the Colorado River supply.

The production, transmission, and distribution system in northern and central California is primarily controlled by the Pacific Gas and Electric Company, which owns 78% of the generating capacity; generates 72% of the total output; and through purchase, transmits and distributes 92% of the total energy to ultimate customers. Hydroelectric power is purchased wholesale by this system from several publicly owned plants which are operated as by-products of water developments. The

World's Highest Dam—Besides Los Angeles, the Cities of Pasadena, Glendale, and Burbank Use Electricity Generated Here at Boulder Dam

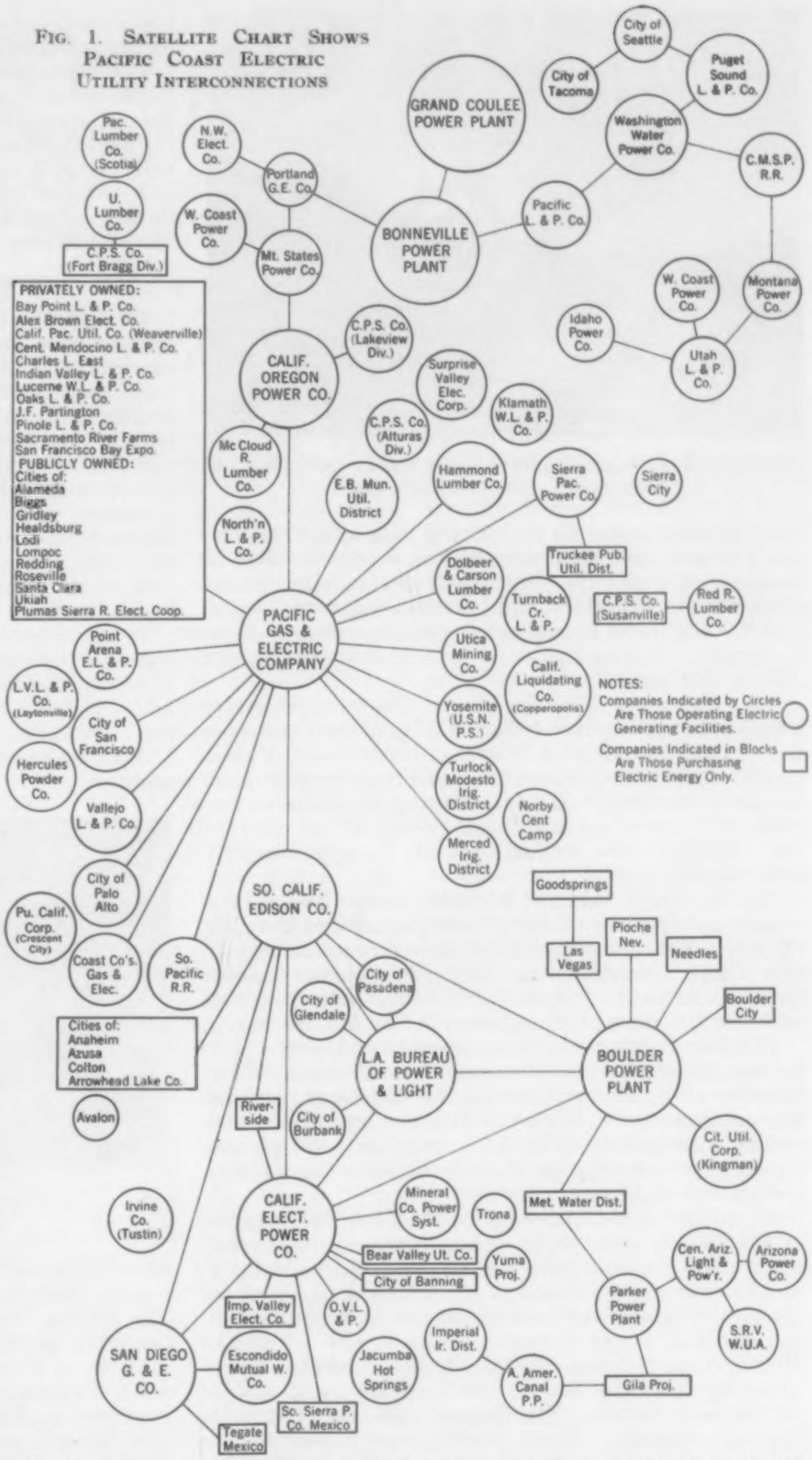
company sells energy wholesale to a number of small municipally owned distribution systems. Power is also purchased from The California-Oregon Power Company (42,000 kw), whose plants are located on the California-Oregon border; and from the Southern California Edison Company, Ltd. (75,000 kw at present, 150,000 kw in the future). The latter delivery is received in the South San Joaquin Valley and is obtained from the Edison plants on the San Joaquin River.

The main transmission system of the Pacific Gas and Electric Company comprises 740 circuit-miles of 220-kv lines extending from the Pit River near Shasta and from the Sierra Nevada east of San Francisco to the Bay District, and southward into the San Joaquin Valley. There are also 2,362 circuit-miles of 165-kv and 100-kv lines extending throughout the area served and connecting the hydroelectric plants to the main load centers. An extensive 60-kv network (3,881 circuit-miles) comprises the secondary transmission system. The total installed plant capacity supplying northern and central California included 1,100,000 kva of hydroelectric capacity and 440,000 kva of steam-electric capacity as of January 1941. The total capacity purchased from the Southern California Edison Company and The California-Oregon Power Company was 115,000 kva as of January 1941. The safe peak capability of the combined systems was approximately 1,200,000 kw, and the 1940 energy requirements were 6,300,000,000 kwhr.

In southern California, power is supplied by two major systems—the Southern California Edison Company and the Los Angeles Bureau of Power and Light; two intermediate-sized systems—The California Electric Power Company (formerly The Nevada-California Electric Corporation) and the San Diego Gas and Electric Company; several smaller municipal systems, including the cities of Pasadena, Glendale, and Burbank; and the Imperial Irrigation District.

The Edison system in the main is operated at 50 cycles, only that portion serving in the San Joaquin Valley being operated at 60 cycles. As of January 1, 1941, it included hydroelectric plants of 410,000-kw capacity in the Sierra Nevada; three 220-kv circuits extending 250 miles therefrom to the Los Angeles metropolitan area; and two 82,500-kva generating units at Boulder Dam, with one 220-kv transmission line to its southern California system; a steam-electric plant of 369,000-kw capacity at Long Beach of which 50,000-kw is leased to the City of Los Angeles; and a 30,000-kw diesel-electric plant at Vernon. The total annual output in 1940 was 3,650,000,000 kwhr. By 1942, a third generator will be added at Boulder Dam, and a second 220-kv transmission circuit.

FIG. 1. SATELLITE CHART SHOWS PACIFIC COAST ELECTRIC UTILITY INTERCONNECTIONS



The Los Angeles Bureau of Power and Light is the largest municipal electric utility in the United States. It operates at present six 82,000-kva units at Boulder Dam, two of which supply energy to the Metropolitan Water District of Southern California; three 287.5-kv transmission circuits, each 270 miles long, to the City of Los Angeles; 90,000 kw of hydroelectric capacity on the Los Angeles Aqueduct; and 140,000 kw of steam-electric capacity in the Los Angeles metropolitan area. The annual power output is approximately 1,900,000,000 kwhr. This system also generates and transmits 35,000

THREE 287,500-V SINGLE-CIRCUIT LINES CARRY BOULDER DAM POWER OVER CLARK MOUNTAIN, CALIF.

kw of Boulder power for the cities of Pasadena, Glendale, and Burbank, municipalities which now have or will have in operation during the coming year steam-electric plants of 50,000-kw, 20,000-kw, and 10,000-kw capacity, respectively. The total annual energy requirements of these three cities during the year 1940 was approximately 210,000,000 kwhr.

The California Electric Power Company operates a system extending over 450 miles from Mono County on the north to the Mexican border and Arizona (at Yuma) on the south, with a transmission line from Boulder Dam to San Bernardino; also a connecting line between San Bernardino and the Seal Beach plant of the City of Los Angeles. Its annual output is approximately 380,000,000 kwhr.

The San Diego Gas and Electric Company operates a steam-electric plant of 100,000-kw capacity in the City of San Diego and supplies all power requirements in San Diego County. The 1940 requirements totaled 280,000,000 kwhr. This system is also interconnected with the Edison and the California Electric systems.

The transmission system of northern and central California is a completely unified and interconnected system, whereby all power available can be utilized as required. The interconnection with the Edison Company—which will be increased to 150,000 kw this year—will provide for adequate interchange of power between the northern system and southern California.

Although limited somewhat by the 50-cycle operation of the Edison system (the others operate at 60 cycles) there are interconnections between the Edison Company and the Bureau of Power and Light through a frequency changer of 60,000 kva, and 35,000 kva between the Edison and San Diego systems. There is also a tie-in of 10,000 kva between the California Electric Power Company and the San Diego Company, and one of 30,000 kva between the Bureau and the California Electric systems. These interchange capacities are sufficient to facilitate full use of most (if not all) of the spare capacity and output of the several systems.

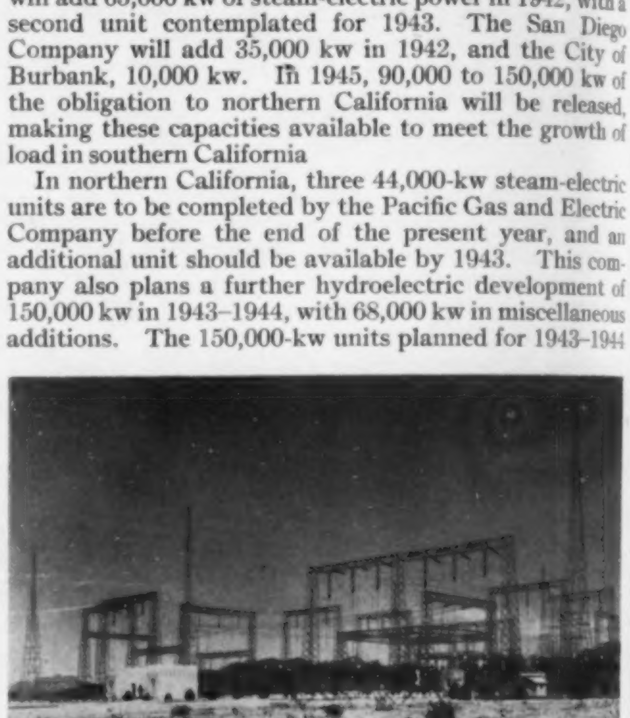
Boulder Dam is the major source of hydroelectric power in the southwestern section. Its annual firm energy output is estimated at 4,330,000,000 kwhr. From time to time there will be at hand fairly large amounts of secondary energy and when the reservoir is full—as it is in 1941—secondary energy should be available during the next several years. With the generating units already set up and others under construction, the Boulder plant will have a total installed capacity of 950,000 kw by 1942. Up to the present time, the annual output has slightly exceeded 3,100,000,000 kwhr.

The Metropolitan Water District of Southern California has contracted for 34% of the firm power at Boulder, to be used in pumping water to southern California. Its immediate needs are less than one-third of the ultimate demand and the energy contracted for will be available to other systems; therefore there is still sufficient unused output at Boulder to meet the growth of load in this area during the next year or two.

ANTICIPATED NEW DEVELOPMENTS

In 1942, the U.S. Reclamation Bureau is expected to complete the installation of 90,000 kw of hydroelectric capacity at Parker Dam on the Colorado River, the major part of which will be used to supply central and southwestern Arizona and the Metropolitan Water District of Southern California. The City of Los Angeles will add 65,000 kw of steam-electric power in 1942, with a second unit contemplated for 1943. The San Diego Company will add 35,000 kw in 1942, and the City of Burbank, 10,000 kw. In 1945, 90,000 to 150,000 kw of the obligation to northern California will be released, making these capacities available to meet the growth of load in southern California

In northern California, three 44,000-kw steam-electric units are to be completed by the Pacific Gas and Electric Company before the end of the present year, and an additional unit should be available by 1943. This company also plans a further hydroelectric development of 150,000 kw in 1943–1944, with 68,000 kw in miscellaneous additions. The 150,000-kw units planned for 1943–1944



SILVER LAKE SWITCHING STATION ON BOULDER TRANSMISSION LINE

have been questioned by the Department of the Interior and the Federal Power Commission and may be held up. The Shasta Plant of the Central Valley Project is expected to be placed in operation by 1945, with an initial capacity of 300,000 kw. The Reclamation Bureau plans a 150,000-kw steam-electric plant at Antioch as an auxiliary to the Shasta Plant. The completion of this unit depends upon Congressional appropriations.

The rate of growth of the power load throughout the Pacific Southwest has not been greatly accelerated to date as the result of war activities. On the other hand, a very rapid increase has been experienced in some areas—particularly in San Diego and in certain districts of the metropolitan area of Los Angeles. The year 1942 should record a marked acceleration of the rate, however, as the full effect of the defense program is realized. Power plant capacities now available and under construction would appear to be adequate to meet all reasonably expected loads.

Motor-Vehicle Performance Studied by New Methods

By J. Trueman Thompson, M. Am. Soc. C.E.

Professor of Civil Engineering, Johns Hopkins University, Baltimore, Md.; Chief Highway Engineer, U.S. Public Roads Administration

For a number of years the U.S. Public Roads Administration has been studying the effect of driver behavior and vehicle characteristics on the movement of traffic. Prof. Thompson, who has been steadily connected with these developments, told of the "Driver Behavior" phase of the subject in the October issue. In this issue he gives the second phase on "Motor-Vehicle Performance." As yet no final results can be given, but samples of data are presented together with some very interesting early conclusions. Prof. Thompson gave his original paper before the joint session of the Highway and City Planning Divisions at the Society's Spring Meeting in Baltimore. In this second part he treats specifically of the performance on grades of trucks, tractor-truck semi-trailer combinations, and passenger vehicles. He also tells of the extensive plans for brake research which the Public Roads Administration has recently embarked on. This is a much needed study.

In discussing the behavior of the motor vehicle it seems necessary to start out with a truism. It is a common experience of motorists to be delayed by slow-moving vehicles—frequently on hills. The passenger car is capable of attaining relatively high speeds even on the steepest slopes ordinarily encountered. But motor trucks and combinations, such as tractor semitrailers, display a marked inferiority in this respect. The resulting traffic queues are often long and very slow moving. Aside from the loss in time and efficiency that ensues, there is the danger that impatient drivers will take risks by encroaching on the downhill lane in an attempt to pass. In so doing they are necessarily at a double disadvantage because not only is the grade component opposing them but it is also hampering attempts of oncoming drivers to slow down should that be necessary.

Several years ago, the Public Roads Administration, with the cooperation of the Quartermaster Corps of the U.S. Army, the Bureau of Standards, and a number of truck manufacturers, undertook a program aimed at supplying information which could be used by state and federal regulating bodies as well as by the truck manufacturing and operating industries. It was divided into three parts: (1) precise and detailed testing of new trucks on various gradients, (2) similar testing of a limited number of used trucks of make and model similar to the new ones previously tested, and (3) studies of traffic movements which involve the performance of trucks as they occur at random on hills. In the last-named investigations the passing-study equipment plays a dominant role. The first two phases are practically completed and a final report is in progress. The field work of the third is also about done.

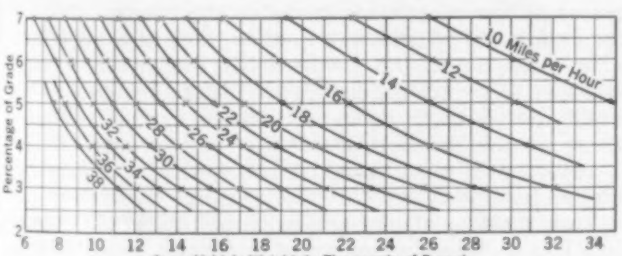


Fig. 1. Ability on Grades of Light Trucks and Tractor Trucks, Without Governors

The purpose of testing new vehicles was to determine the optimum performance that could be expected of them on grades in the present state of their development; this would serve as the present theoretical ceiling of requirements in possible regulations.

Through the generous cooperation of the automotive industry, about thirty brand new chassis were furnished. Some were trucks, some were tractors. The majority used gasoline as fuel but a few diesel-powered ones were included. The truck chassis always used the same body while the tractor chassis invariably drew the same semitrailer. The variable load in each case was provided by sand bags of known weight.

These vehicles were road tested on several long tangent grades near Baltimore, after which their engines were cradle-dynamometer tested at Camp Holabird, through the cooperation of the Quartermaster Corps of the Army. Actual hill tests were desirable because there was some doubt about the empirical coefficients ordinarily used in the performance formula by which automotive engineers compute hill-climbing ability, and also because it was felt that the validity of the data would be more likely to go unchallenged in any future contacts with layman courts and regulatory bodies if they were so based.

The performance formula referred to expresses the relation of road speed and gross weight of the vehicle in terms of engine power, efficiency of power transmission, grade resistance, wind and rolling resistance, and the multiplying leverages effected through gears and wheels. All these factors are easily and separately measurable except efficiency and rolling resistance, including wind. One of the accomplishments of the experiments was to produce a set of values in this respect which are of great use to the industry—but which will not be stated here.

The testing technique was simple yet effective. A calibrated bicycle wheel attached to the front of the truck was so arranged that on every half revolution it closed and opened an electric switch mounted on its hub. (See accompanying photograph.) This permitted an intermittent flow of current through a circuit in which was inserted an electromagnetically operated stylus writing on a strip of paper fed under it at a uniform speed. A second stylus, which was in an independent clock circuit, indicated time intervals on the same strip of paper. Thus the record permitted a very accurate determination of speed and likewise made it possible to judge the uniformity of the speed with which the vehicle was able to negotiate the grade. Testing was always done at full throttle, and the load was changed until that load was found which would just hold the speed constant on the grade with the given gear ratio.

HILL-CLIMBING STUDIES WERE MADE WITH TEST VEHICLES EQUIPPED WITH A FIFTH WHEEL

A sample of the summarized test data is shown in Fig. 1, which is for light trucks and tractors only. It shows the relation between gross weight, speed, and grade. Similar curves are available for the medium and heavy weight classes.

After the tests on new vehicles had been completed, the same tests were made on similar makes and models that had been in service long enough to put fairly large mileages on them. The idea here was to see what, if any, decrease in ability took place with use, and to apply this information to properly discount the standards set by the new vehicles. The methods of testing were essentially the same as for the new vehicles.

NEW AND USED TRUCKS COMPARED

When the test data for the new and used trucks were compared, it was found that the used trucks showed little or no depreciation; indeed, a few of them seemed to improve slightly. It is not suggested that this be looked on as a generally applicable conclusion, however; it should be noted that the only used vehicles it was possible to get hold of were borrowed from large operators, and maintenance was probably better than average. But it does indicate that with proper maintenance there is no need to fear any marked decline in ability.

Thus far the only attempt that has been made to relate the data to road conditions was on U.S. Route 1, between Richmond and Fredericksburg, Va.—a distance of 52 miles. There it was desired to study the effect on commercial vehicles of imposing various grade-ability requirements, expressed in terms of speed and percentage of grade. The results are summarized in Figs. 2 and 3. The data obtained by the planning survey weight stations on this route give the number of vehicles in the light, medium, and heavy classes of trucks and tractor semi-trailers involved in the average daily 24-hr traffic. They also give the gross weights of the individual vehicles in each class. From ability data like that shown in Fig. 1, it is possible to tell how many vehicles would be able to meet the various levels of ability indicated.

From Fig. 2 it is seen that at least 95% of the light, single-unit trucks can negotiate the 3% and 4% grades on this route at speeds of 15, 20, or 25 miles per hour, but that if a requirement of 20 miles on a 6% grade, or 25 miles on a 5% grade were imposed, an appreciable number would be affected. Over one-quarter of the light trucks would be ruled off the road or required to reduce their loads under a requirement of 25 miles per hour on a 6% grade. While this percentage may not appear large, it should be observed that vehicles of the light class constitute about 80% of the trucks using this road.

The general patterns of the charts for the medium and heavy groups are quite like those of the light group except that the percentage incapable of each minimum speed on the several grades is somewhat larger than for the light trucks. Even so, the actual number of these heavier vehicles unable to make the desired speed is far less than the number of light vehicles similarly incapable.

Similar information for the tractor semi-trailers appears in Fig. 3. Contrasting them with the light trucks, one is immediately struck by the large number in the light group that are incapable of reasonable performance. Almost half of them, for example, fail to make the 5% grade at even 15 miles per hour, and over a third cannot climb a 3% grade at 20 miles per hour. The medium group likewise contrasts unfavorably with the medium-weight trucks.

The hill-climbing data were also used to measure the effect of several possible grade-speed requirements on load-carrying practice on this road. As an example of this use, Fig. 4 gives frequency distribution diagrams of gross weights as measured at the weighing stations. From the curve for light trucks, it is seen, for example, that about 60% were loaded and 40% empty; that 40% have gross weights of 8,000 lb and pay loads of about 2,000 lb; that 20% have gross weights of 13,000 lb and pay loads of 7,000 lb; and so on. We also know from the hill-climbing data that the average truck in this class can climb a 4% grade at 20 miles per hour with a gross load of 21,000 lb. If this grade and speed were required, any load beyond 21,000 lb would represent an excess, which would have to be removed from the pay load before the truck could qualify. These excesses are shown in the curves of Fig. 4 for trucks and for tractor semi-trailers, both of the light class. Again the contrast is striking. Only about 10 light trucks, or about 1%, fail to qualify, while in the light tractor semi-trailer group, about 60% are carrying excess load which would disqualify them. These data also show that tractor semi-trailers on this road are empty much less frequently than are single-unit trucks—14% and 40%, respectively.

The purpose of the random studies is to secure a large mass of data portraying the movement of traffic on hills as it is affected by the presence of vehicles which must travel at low speeds compared to the others. Such information will be used as a further guide in fixing reasonable regulations, and is the basis for broad decisions whether to reduce grades, lighten loads, increase power, build special truck lanes, or perhaps employ several of these possible ameliorative devices in combination.

In order to meet these purposes, the data should be able to furnish answers to questions like these:

How serious is the impedance to traffic? A probable index is the number of units and their spacing in the traffic queue behind vehicles crawling at different speeds.

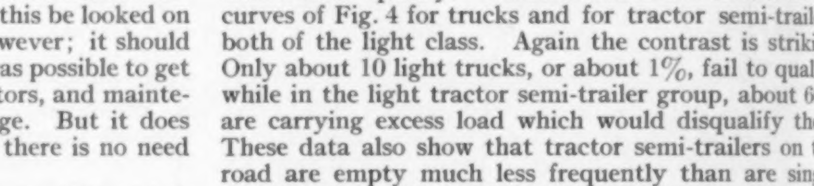


FIG. 2. ABILITY ON GRADES OF SINGLE-UNIT TRUCKS

How serious is the induced exposure to danger? A probable index is the number of drivers who become impatient and try to pass.

If a minimum speed limitation be imposed, what should it be? The variation of the length of time and distance which passing vehicles must spend in the opposing traffic stream, with the crawl speed of obstructing units, may prove a possible index.

What is the effect of vehicle type and weight class on traffic impedance for a given grade?

What grades are critical in causing impedance?

What is the effect of length of grade?

As previously stated, the field work which was carried on with the cooperation of several states has been practically completed. In general the equipment and techniques employed in the passing studies were used. Since it was obviously desirable to be able to identify some of the vehicles and to learn something of them in specific detail, the license numbers of all trucks and combinations were noted as they passed one of the three synchronized recording stations and incorporated into the record. Well beyond the top of the grade these vehicles were stopped, weighed on portable scales, and described as to type, make, model, year, rating, and so forth.

Thus far only a small fraction of the ultimate mass of information has been reported. (See "Sample of Data Obtained in Study of Motor-Vehicle Passing Practices in Illinois," by F. N. Barker, *Public Roads*, Vol. 20, February 1940.) What happened on U.S. Route 66 in Illinois during 310 seconds of one October afternoon is shown by an ingenious method in Fig. 5. The pavement was 20 ft wide, the grade 6%. The time-distance curves show the progress of vehicles through the test section. Curves sloping to the right indicate vehicles ascending the hill and those sloping to the left indicate descending vehicles. The ordinate between any two curves indicates the distance, in feet, between the front axles of respective vehicles. A little study of the chart will reveal that it indicates many useful and important measurements and facts. For example, it shows:

1. The speed of each vehicle at every point (slope of the curves).
2. The accelerations and decelerations of each vehicle throughout the course.
3. The time and point on the hill where any vehicle trespassed on the opposing traffic lane (dotted lines), the duration of the trespass in time and distance, and the point of return to the normal lane.

But more important still, it shows in permanent recorded form exactly what every vehicle did during every one of those 310 seconds with respect to every other vehicle. Vehicle (1), a tractor semi-trailer, entered the course at 20, but had gone only 500 ft before its speed was reduced to less than 5.5 miles per hour. It caused one

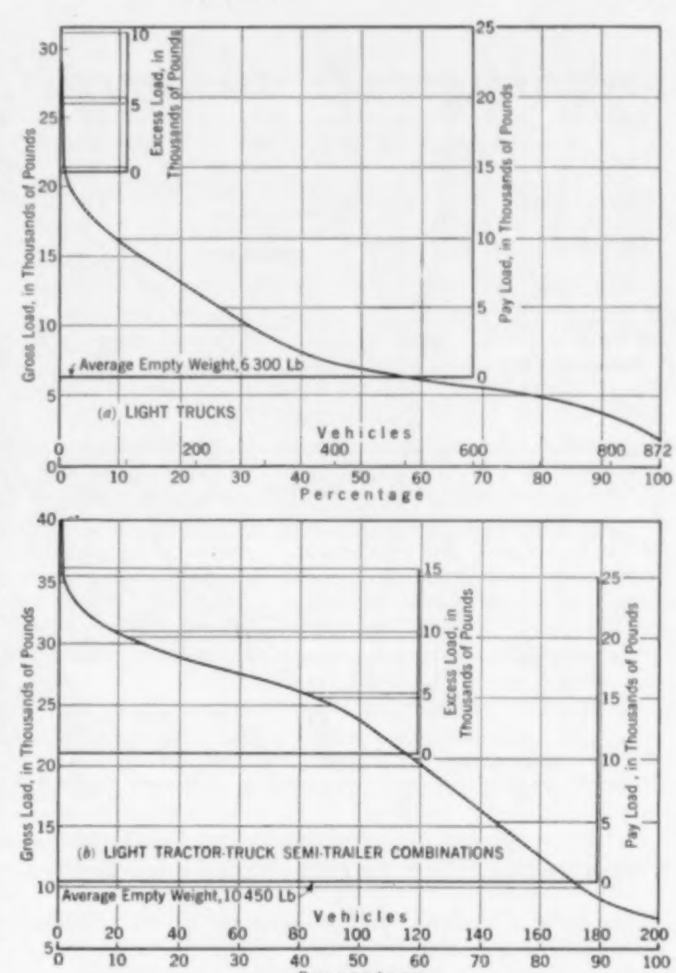


FIG. 4. AVERAGE PAY LOAD AND EXCESS LOAD FOR LIGHT TRUCKS AND FOR LIGHT TRACTOR-TRUCK SEMI-TRAILER COMBINATIONS ON A 4% GRADE AT 20 MILES PER HOUR

vehicle (2) to pass which was able to accelerate to 35 before it left the grade. An interesting example of the influence of oncoming traffic is seen in the attempt of (2) to pass (1) at abscissa 14 seconds. When (2) encroached on the left lane, a vehicle coming down the hill was 1,050 ft away; this was too close for the driver of (2) and so he cut back into his own lane, and continued to follow the tractor semi-trailer until later.

Vehicle (3), which was also a tractor semi-trailer, could ascend the grade at only about 5 miles per hour. This low speed, coupled with the presence of at least five oncoming (descending) vehicles, caused delay to about a dozen vehicles in all, some of which were obviously capable of, and apparently desired, speeds of 40 miles per hour or better. It was also responsible for six encroachments on the left lane, only three of which resulted in an accomplished passing.

Thus it is seen that the records being prepared have a complete and detailed story in them. They are as vivid as any motion picture film! It should not be long before general conclusions and recommendations begin to emerge from them.

Within the past year (1941) the Public Roads Administration has undertaken an extensive investigation of

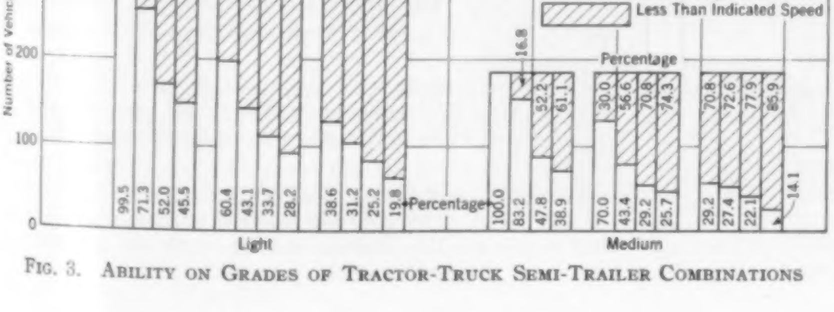


FIG. 3. ABILITY ON GRADES OF TRACTOR-TRUCK SEMI-TRAILER COMBINATIONS

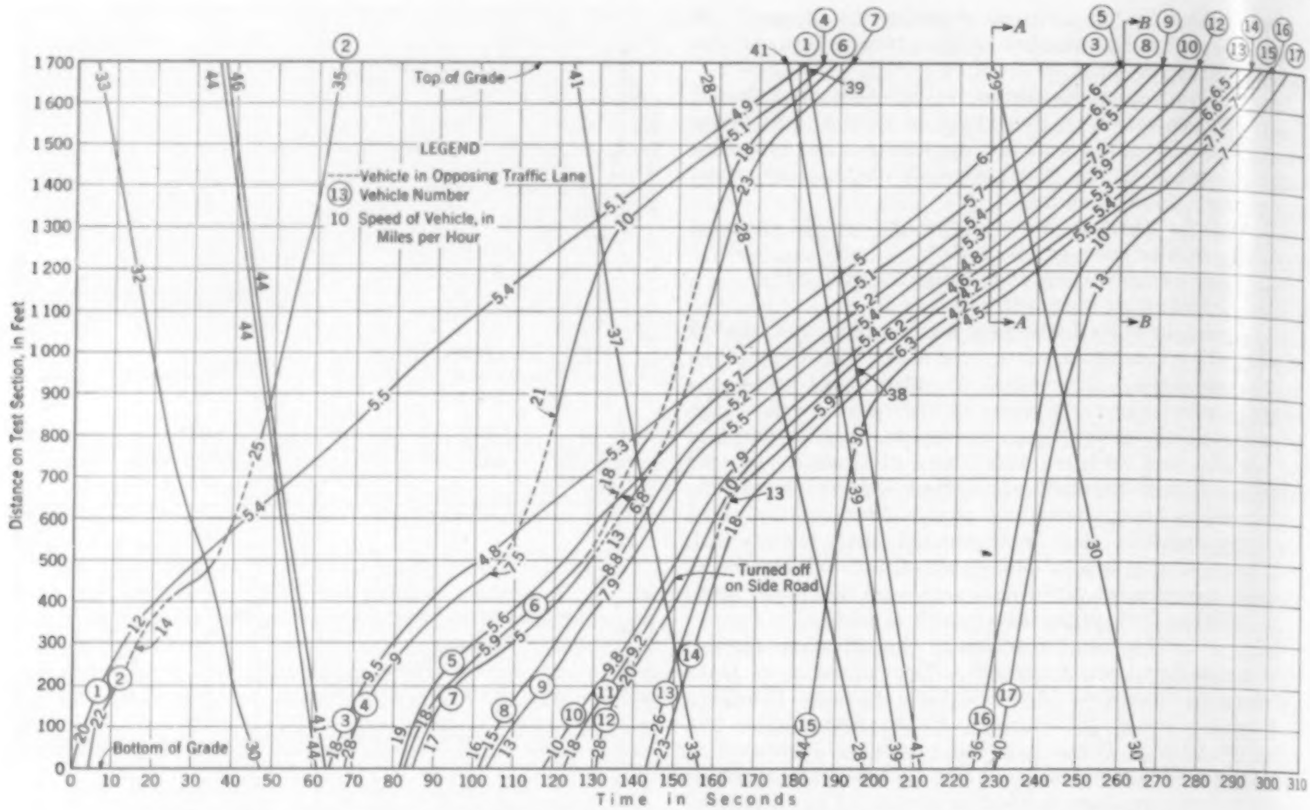


FIG. 5. TIME-DISTANCE CURVES SHOWING PROGRESS OF VEHICLES THROUGH A TEST SECTION IN 310 SEC
Vehicles Numbered 1, 3, 5, and 8 Were Tractor-Truck Semi-Trailer Combinations; 13, a Medium Truck; All Others, Passenger Cars

motor-vehicle brakes. Other agencies of the Federal Government are also interested in the performance of vehicles: the Interstate Commerce Commission, because it must promulgate and enforce safety regulations; the Bureau of Standards because it is called on to advise other branches of the Government in preparing specifications for motor-vehicle purchase; the War Department, because of its procurement, operation, and maintenance of both standard and special automotive equipment. The Administration has agreed to carry on the brake research and these other interested Government agencies are cooperating. At the same time, it asked the automotive industry to create a representative committee to participate in the work and particularly to advise the Administration. It is known as the Advisory Committee on Motor Vehicle Brake Research. On it are representatives of manufacturers of motor vehicles, of brakes, brake-lining materials, and brake-testing equipment. The Society of Automotive Engineers is also represented, as are the insurance groups, the operators of trucks and busses, and the motor-vehicle administrators.

At its first meeting, in March 1941, the Advisory Committee approved a program for the investigation which is far and away the most extensive ever undertaken in this field. The main purposes of the investigation are (1) to provide basic information, not now available, on which can be based fair and reasonable brake performance requirements for the use of regulatory bodies; (2) to determine practical means of enforcing brake regulations; and (3) to establish a better understanding of certain features of the braking phenomenon.

In order to accomplish (1) it is necessary to have a comprehensive picture of how well existing vehicles in service can stop in an emergency. In the absence of this sort of information, there is grave danger that regulatory bodies will place their requirements so high that they cannot be met by a large majority of the vehicles actually on the road. In order to provide such a comprehensive picture, it was decided to measure the stopping ability of vehicles at 10 widely separated points in the United States. There will be, all told, about 3,000 commercial vehicles and at least 1,000 passenger cars in the sample. In the commercial-vehicle group the attempt will be made to include an equal number of single-unit vehicles and combinations. Busses will be excluded for the present.

Work of an exploratory nature was carried on in the late fall in Maryland between Baltimore and Washington. Since then the field party has completed work in Alabama, Texas, California, Washington, Colorado, Iowa, and Illinois. From there the party will swing back to the East and complete the survey before winter sets in.

The Public Roads Administration has recently purchased a 1,200-acre tract of land near Washington. Among other facilities to be located there will be those necessary for accomplishing the other purposes outlined in the program. It is planned to assemble there a number of brand new vehicles equipped with representative brake systems and types. These will be exhaustively tested under controlled conditions for the purpose of determining the optimum brake performance of which vehicles of current manufacture are capable. This will fix a "ceiling" for regulatory bodies to consider. The testing of both service brakes and auxiliary brakes is contemplated.

Besides collecting the results of these studies in one place for the first time, it has been the purpose of this paper to point out how sadly such data have been lacking in the past, their significance, and the implications of their use for the future. The examples given of what has already been accomplished should encourage the hope that soon we will be able to answer many of the questions that have plagued us in the past.

Steel-Frame Building Moved by New Method

Pavilion of Willard Parker Hospital, New York, Transported 60 Ft on Rollers by Means of Interconnected Hydraulic Jacks

By Charles B. Spencer, M. Am. Soc. C.E.

Vice-President, Spencer, White and Prentis, Inc., New York, N.Y.

Aside from a record of achievement, this paper presents methods that explore a new field and open up possibilities never dreamed of a few years ago. Upon the solid basis of accomplishment, it shows how buildings of considerable bulk and weight can be raised and moved at will. More than that, it shows how this can be done with the greatest of precision and at a surprisingly small cost. Mr. Spencer speaks with authority as a responsible officer of the firm which not only did the work but devised the method of doing it.

One need not be very old to remember the thrill of seeing a large Victorian house moving slowly down the street, while a patient old horse walked endlessly around a capstan supplying the motive power. Within the present year an entire seaside bungalow colony was moved more than a mile to make way for the great Quonset Point Naval Base. The motive power in this case was a powerful caterpillar tractor, which whizzed the skid-borne frame houses across the fields at a speed of several miles an hour. Only a few weeks ago we were entertained by pictures in the newspapers of a small house lying on its side in a ditch. It appears that an ambitious house-mover undertook to transport the building on a truck. The truck was strong enough to carry the light load, but an uneven road bed, possibly aided by a gust of wind, soon freed it of its unaccustomed burden.

Buildings have grown larger, but engineers have been amazingly timid in applying modern methods and equipment to the moving of the heavier structures. Despite mounting construction costs, the erection of a new building nearly always has required the demolition of the existing structure. Oftentimes the latter was comparatively new, and good for many years of service if moved to an adjoining location either vacant or occupied by small buildings whose demolition would involve no great loss.

The widening of highways usually has resulted in the demolition of many valuable buildings, or at least the cutting off of such portions as interfered with the proposed roadways. When, in the construction of a subway, a bend in alinement necessitated encroaching on private property, there seemed to be but two possibilities—demolition of the encroaching buildings, or tunneling beneath their foundations, each involving tremendous expense. Moving the buildings to clear the new construction was rarely ever considered. On a recent subway job, the successful contractor bid $500,000 for the additional cost of constructing the railroad where a curve carried the structure under part of a twelve-story concrete building. This was more than the value of the entire building, and the city effected some saving by purchasing the building and tearing it down.

The newly formed Department of Public Works in New York City has recently departed from the usual procedure, and has moved several structures that interfered with new construction work. A three-story brick fire-house was moved clear of the new Cross Island Boulevard in Whitestone, Long Island, and a similar structure was removed from the right of way of the Eastern Boulevard in the Bronx. In both cases the cost of moving was only a fraction of the worth of the building. The methods used in moving these fire-houses were those customarily employed by house-movers. Large timbers supplemented by steel took care of the heavier loads, and old Dobbin's feeble strength was replaced by the more powerful pull of trucks and tractors.

Willard Parker Hospital, at 15th Street and the East River Drive, is the largest hospital in New York City handling only contagious diseases. Its facilities are already overtaxed, so that when it was found that Pavilion No. 3 interfered with the construction of the New East Side Drive, the Department of Public Works was confronted with a real problem. Funds for demolition and reconstruction in a new location were not available. Furthermore, the loss of time involved would have been serious to the hospital. This five-story building has a total weight approximating 2,350 tons. It has a steel frame with brick walls, and the floor dimensions are 80 by 30 ft, with a 26-ft elevator extension six stories in height.

It was felt that the occupancy of the pavilion could not be disturbed until the summer, at which time the building would be moved approximately 60 ft to the

Prior to Moving, Pavilion No. 3 Stood on Sharp Curve of Temporary East Side Drive

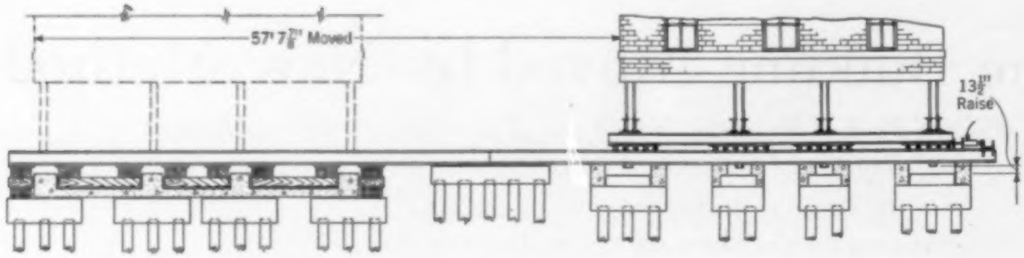


FIG. 1. SCHEMATIC ELEVATION SHOWING METHOD OF MOVING BUILDING BY ROLLERS FROM OLD (RIGHT) TO NEW (LEFT) FOUNDATION

west to clear the new roadway. In the meantime, the drive was partially constructed past the building, clearing it by only a few feet and creating a dangerous condition. When the contract was advertised, Commissioner Irving V. A. Huie, M. Am. Soc. C.E., felt that the importance of the building was such as to be of interest to contractors experienced in underpinning work and other types of construction requiring the handling of heavy loads. Contractors who had had experience in handling heavy loads were invited to bid upon the work. The low bidder was Spencer, White and Prentis. Upon the award of the contract, the contractor's engineers prepared a detailed plan of the entire operation, in which every member was carefully designed. All column and wall loads were accurately computed, and subsequently checked by means of the hydraulic jack pressures, supplemented by extensometer readings.

The column loads were carried through transverse "tripper" beams to "runner" beams, which rested on rollers running on steel "track" beams. To test the behavior of such a set-up, a typical "column" was built in the contractor's construction yard. Caisson weights totaling 74 tons, the computed dead load of an average column, were piled on transverse beams resting on runner beams and track and moved several feet by hydraulic jacks on the rollers to be used in the moving of Pavilion No. 3. It was anticipated that in the actual moving, the runner beams might in some cases not be centered directly over the track. So as to make the test under the worst conditions, the webs of the running beams were set eccentric to those of the track beams by $1^1/_2$ in. The test set-up worked perfectly, and by means of hydraulic gages the moving forces were known at all times. It was found that, for starting, a horizontal force of 3,000 lb was required, but once in motion, the system could be kept moving by a force of approximately 2,000 lb. No tipping or other adverse tendencies were noted due to the eccentricity of the beams.

The first step in the preparations for moving the building was the excavation to cellar grade between the new location and the old, since the plan called for the location of the track on which the building was to be rolled at the lowest practicable grade. The material at subgrade was found, as anticipated, to be a miscellaneous fill of negligible supporting power. It was necessary to drive wood piles in two rows at each track location. These piles penetrated about 40 ft and were capped with concrete made from high early strength cement. When in place, the track beams rested on firm foundations throughout, the easterly portion on the old foundation of the building, the center on the wood pile piers, and the westerly portion on the new foundation installed by another contractor (Fig. 1).

In the meantime the tripper beams had been welded to all columns. These were generally 15-in. I-beams, 60.8 lb per ft, whose flanges had been cut away on one side to bring the web in contact with the columns. As each set of trippers was completed, it was tested by means of hydraulic jacks placed on the existing foundations. An overload of at least 50% was applied, and in no case was any impairment of the weld or visible deflection of the beams noted. Although certain of the existing column foundations settled as much as $^1/_4$ in. under the load, such settlement was progressive in only one case. This foundation settled at a rapid rate and tilted down to the north. Excavation was carried beneath the concrete, and it was found that, because of the incorrect location of the existing wood piles, the column was resting on the northerly edge of the group. To make this foundation safe, a 12-in. pretest sectional cylinder was installed hydraulically below the concrete cap.

Specifications provided that the building in its new location was to be set at an elevation approximately $12^1/_2$ in. higher than on its original site. It was decided to do this raising, together with an additional 1 in. for clearance, before moving. The raising was accomplished by means of 52 hydraulic rams, two at each column. Of these, 48 were $4^1/_2$ in. in diameter and 4 were 6 in. in diameter. The jacks, which were set directly over the column billets (previously loosened from their anchor bolts), reacted against the tripper beams. All jacks were supplied from a central hydraulic pump and a pneumatic-hydraulic accumulator, and a control valve was provided at each column. The capacity of the accumulator was sufficient to extend all the rams about $^3/_4$ in. The unit rise was just in excess of $^5/_8$ in. and after each rise a plate $^5/_8$ in. thick was set below the column. At a given signal the valves were opened simultaneously at all columns and closed when the $^5/_8$-in. rise had been accomplished. Although the individual rises required only a few seconds, the entire lifting operation took six hours. The behavior of the structure was continuously checked by level readings taken with two instruments from whose locations all the columns were visible.

Approximately two days were required to install the running beams and lower the building to rest on the rollers. These rollers were sections of shafting 2 in. in diameter distributed at each column in accordance with the dead load. Each roller was designed to sustain seven tons and its full travel was approximately 6 ft—the length of the $^1/_2$-in. liner plates welded on the under side of the runner beams. For the full length of each track, a series of lines 4 in. apart had been drawn on the top flange at right angles to the direction of moving to guide the men in setting the rollers.

MOVING COMPLETED IN ONE DAY

Moving was commenced at 2 p.m. on Tuesday, September 2, in the presence of Mayor F. H. LaGuardia, Commissioner of Public Works Irving V. A. Huie, M. Am. Soc. C.E., Borough President Stanley Isaacs, Commissioner of Borough Works Walter Binger, M. Am. Soc. C.E., Commissioner of Welfare William Hodson, Commissioner of Hospitals W. C. Rappleye, and many other distinguished guests. Power for moving was provided by six hydraulic jacks, one at each line of columns. These jacks were set horizontally, tack welded to the easterly end of the running beams, and traveled with the building. They reacted against clamps attached to

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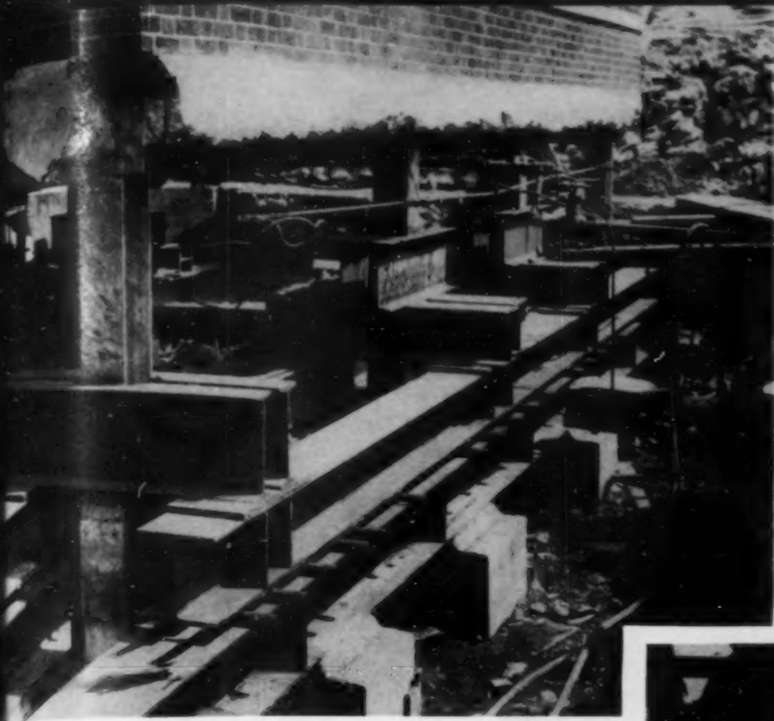
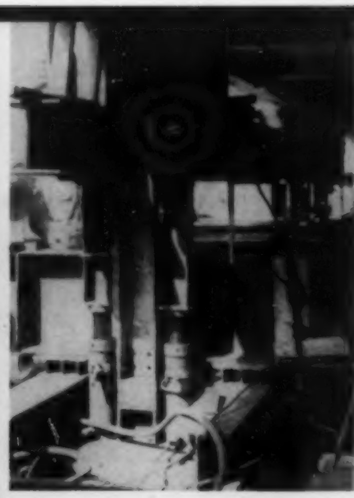
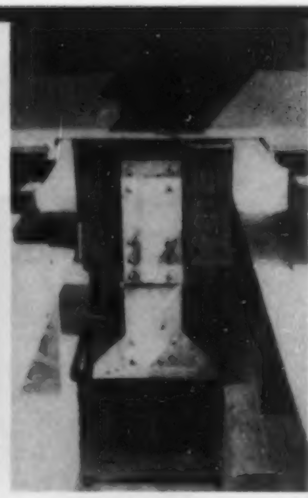


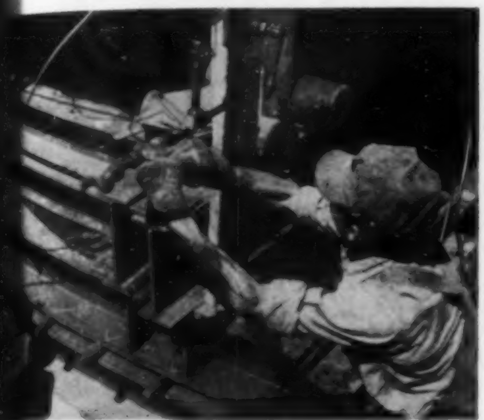
...therly Line of Columns Were Welded Through Connecting Beams to Runner That Rested on Rollers



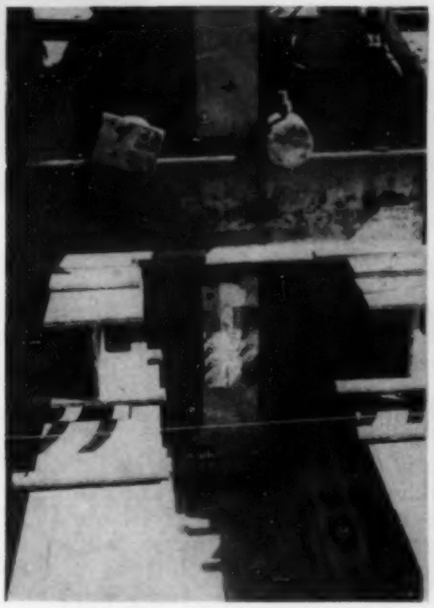
Hydraulic Jacks Raised the Building Before the Runner Beams Were Set



Steel Shims Placed Under Column After Raising with Hydraulic Jacks



Turning One Valve, on Signal, Stopped Movement of Building

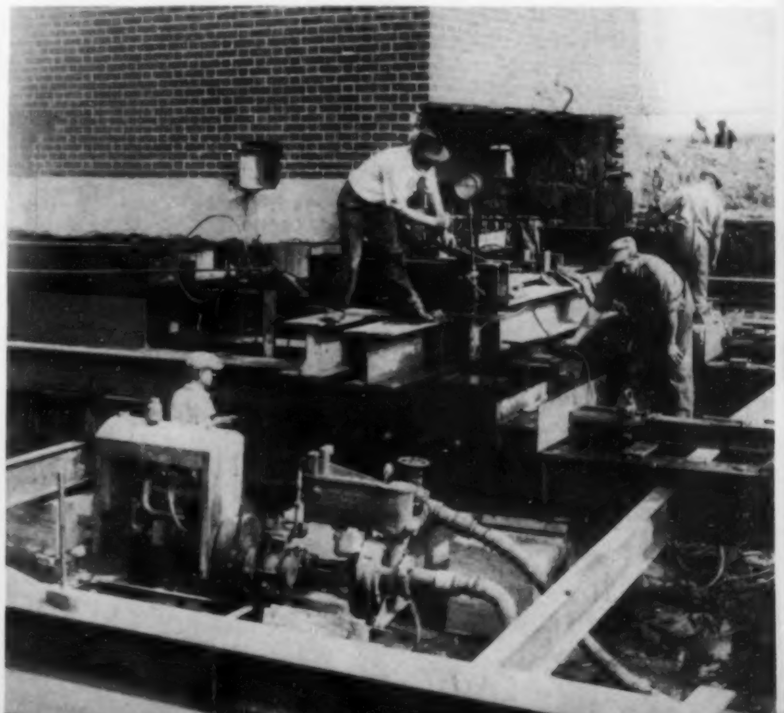


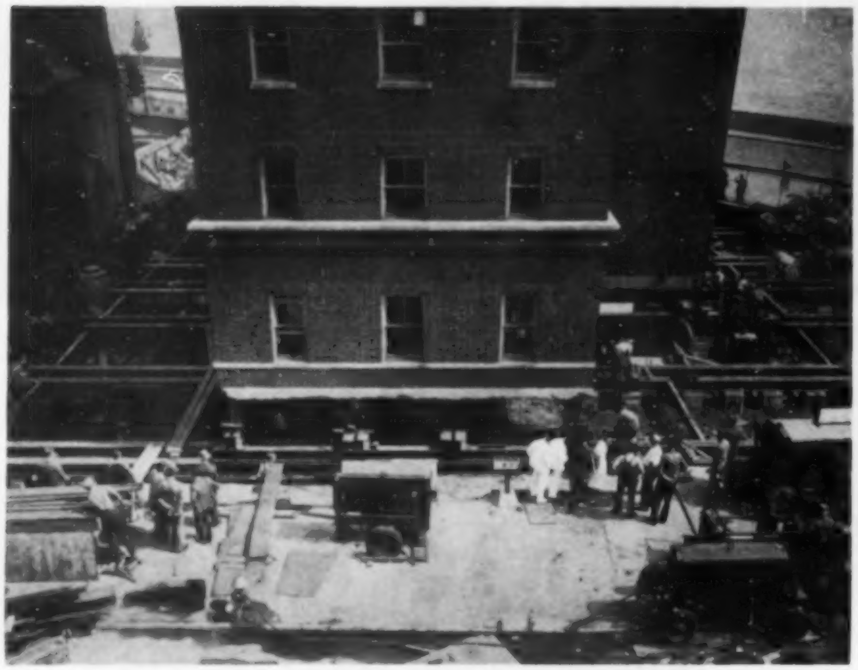
Each Column Had Ample Clearance Over Temporary Pile Caps

Before Moving, Experts Checked and Straightened All Rollers

...Move of Typical Column Load in Contractor's Construc...Yard, Using Hydraulic Pump, Ram, and Reaction Clamp

The First Moving Operation—Opening of Master Valve Immediately Followed by Opening of Control Valve at Each Column





ALMOST HOME
Two Hours Later, the Building Was in Its Final Location

the track beams, and moved the building 10 in. at a time. The rams were supplied by the central pump and accumulator, and controlled by a master valve and a valve at each ram.

At the completion of each move, which required about 30 sec, the jack was retracted, and a die consisting of a short section of H-beam was set in place. The process was repeated until the move had totaled 6 ft, when the clamp on the track was moved forward. The progress on the first day was approximately 6 ft per hr, while on the second day the average progress was 10 ft per hr. The contractors' organization believes that, using rams of longer stroke, these rates of progress could be greatly increased.

The building arrived at its destination at 2 p.m. on Wednesday, September 3. A check disclosed that no portions were out of location more than $^1/_4$ in. It had been assumed that the new foundations would settle approximately $^1/_2$ in. under the load of the building, and allowance had been made in the raising to take care of this amount. Only a portion of this settlement was obtained, with the result that, when the moving was completed, the columns averaged more than $^1/_4$ in. high. This was satisfactory to the Department, and the building was set at this elevation. The setting was accomplished by wedging the billets up against the column base and "dry packing" in place with stiff concrete. The tripper beams were slowly cut with an acetylene torch, permitting the building to settle slightly and bear on the foundations. The contractor completed his contract by removing the track, runner beams and rollers, and backfilling the original cellar and the space between the two locations.

SOME OUTSTANDING DETAILS OF THE WORK

Many details considered routine by the contractor caused comment among the spectators. Among these might be mentioned the following:

1. A yellow line on one of the tracks at each end of the building marked the center of the beam longitudinally. Welded to the runner beam was a steel pointer which traveled a fraction of an inch above the line. As the building moved, this pointer was always on the line marking the center of the track.
2. The jacks were all equipped with racks on their side, facilitating their retraction after each move.
3. A system of bells gave the "ready-set-go" for the opening of the valves.
4. Two engineers stood with their eyes glued to the transits checking alinement.
5. The pneumatic-hydraulic accumulator was equipped with an automatic "booster," which kept the air side at a uniform 120 lb per sq in., thus keeping the water side at a uniform 4,320 lb per sq in.
6. The special hydraulic rams had threaded plungers and safety collars.
7. The maze of timber cribwork usually involved in every moving job was absent.
8. Only a comparatively small number of men were used.
9. The moves were accomplished with smoothness and uniformity due to hydraulic power.

Many of the spectators remarked that the contractor was "doing the work too well." Obviously, since the absolute location of the building was unimportant, and since no building or property lines were involved, greater tolerances were permissible. However, since it was hoped that this operation would be a precedent for others involving much heavier buildings under more constricted conditions, the maximum of accuracy was striven for.

As a result of this operation, the contractor feels that the methods used would be equally successful in moving a twenty-story building and raising or lowering it to any extent desired. The moving force required checked almost exactly with the test, showing a rolling coefficient of 1 to 50. Thus, a twenty-story office building on a plot 100 by 100 ft, weighing approximately 15,000 tons, would require a moving force of about 300 tons. This would necessitate only ten $4^1/_2$-in.-diameter rams of the type used, working at a hydraulic pressure of 4,000 lb per sq in.

As already stated, it is believed that the art has been extremely backward in recognizing the feasibility of moving heavy structures. Perhaps the moving of Willard Parker Hospital's Pavilion No. 3 may be the means of saving from the scrap heap many useful structures whose present location happens to block the way of the wheels of progress.

The moving of Willard Parker Hospital, Pavilion No. 3, was done for the Department of Public Works, City of New York, headed by Commissioner Irving V. A. Huie and Deputy Commissioner Homer R. Seely, Members Am. Soc. C.E. Directly in charge of the work for the city were Henry C. Gaffney and William R. Barry; the resident engineers were Thomas McKeon and William Bailey. The engineering staff of Spencer, White and Prentis Inc., the moving contractor, developed the technique of raising and moving, and in addition designed the necessary structural parts. Their general superintendent was Joseph C. Weaver; job superintendent, M. Canale; and engineer in charge, George F. Flay, Jr., Jun. Am. Soc. C.E.

Cotton Highways in Arkansas

Two Experimental Sections, Eight Miles in Total Length, Have Been Completed and Await the Test of Time—and Traffic

By John A. Guissinger, Assoc. M. Am. Soc. C.E.
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THE use of cotton in highway construction has been given wide publicity because of the need of an outlet for our surplus cotton reserves. Of course the engineer's chief interest in this new use of an old product centers on the possibility of thus securing better highways. In this paper Mr. Guissinger describes an actual black-top project on which cotton was employed. He gives details of construction and conclusions. The results are chiefly important to the engineer, as Mr. Guissinger does not believe that enough cotton can be used in this way to affect the cotton market greatly.

PARTICULAR care must be given to the design of a highway foundation because it is especially vulnerable to the attack of the elements and on it depends the safety of the whole structure. Any weak point in subgrade or base beneath a bituminous highway pavement, due to moisture or any other cause, will in time endanger the pavement. Adequate drainage and a better understanding of the behavior of base and subgrade materials, through the study of soil mechanics, are solving the problems presented by moisture below the pavement. Now a new material, cotton fabric, is being added to the list of materials used in highway construction.

Moisture is the enemy of black-top paving. Entering the base through fractures in the wearing course, it lowers the resistance of the base to the action of traffic. To prevent the passage of this moisture into the base, an impervious, bituminous mat is essential between the wearing course and the base, a membrane possessing a measure of resilience capable of resisting the unequal impacts of traffic loads which threaten to rupture the pavement at all points where the base is weak. This quality is not always supplied to the required extent by the materials which ordinarily enter into the construction of black-top highways, particularly in localities in which drainage, subsoil, or available base or surfacing materials are not ideal for such work. In a study of means to supply this need, the application of a cotton-fabric reinforcing membrane has been introduced for experimental purposes. This type of construction has not yet been in use a sufficient length of time to determine its value, but if it serves its intended purpose of providing a permanent waterproofing membrane, it should aid in reducing failures and lowering the maintenance costs of black-top highways.

COTTON USED ON TWO EXPERIMENTAL PROJECTS

Two experimental federal highway projects employing cotton-fabric reinforcing have recently been completed in Arkansas, the more recent being the reconstruction of a part of Federal Highway No. 79, between Magnolia and McNeil, in Columbia County, a southern border county. The following observations were recorded during the construction of this project.

The cotton fabric was furnished by the U.S. Department of Agriculture for experimental purposes and the price of the material did not enter into the contractor's bid. The fabric was a white, open-weave material of 10 meshes to the inch, $6^1/_2$ ft in width, weighing 0.28 lb to the square yard and between 50 and 200 lb to the roll. The base course material consisted of crushed gravel of a maximum size of $1^1/_4$ in. with the plasticity index of the portion passing the No. 40 sieve limited to 6. Reduction of the clay content of base materials also reduces capillarity, but this leads to trouble when cotton fabric is placed between the base and the wearing course because the base absorbs the priming asphalt needed to aid in forming the waterproof membrane.

In applying the prime coat and the cotton fabric the following procedure was used: A coat of 0.25 gal per sq yd of medium curing cutback asphalt No. 1 was placed on the base. Most of this was absorbed by the base and the rest dried quickly. A coat of 0.2 gal of medium curing cutback asphalt No. 2 was then applied and the cotton was placed at once on this prime coat, adjacent widths lapping about 6 in. A second coat of 0.2 gal of MC-2 asphalt was then placed over the cotton and this was followed at once by a sand cover coat of 8 lb to the square yard. Experimental work at the beginning proved this to be the best method of applying the cotton on a base which is low in plasticity.

The ideal base upon which to apply cotton fabric would contain enough clay to prevent the absorption of a high percentage of the priming asphalt. If the greater part of this priming material is lost by absorption into the base and the sand cover coat, not enough will remain to establish the desired waterproof membrane and bond between the cotton and the base. But clay increases capillarity and it would be unwise to sacrifice an advantage in order to assist in proving an experiment. Therefore it is necessary to use sufficient priming asphalt to make up the deficiency due to absorption by a porous base, and also to time the placing of the cotton carefully.

Cotton Is Placed on Initial Prime Coat of MC-2 Asphalt at the Proper Time So That the Asphalt Will Soak Through the Fabric

WHEN THE COTTON FABRIC IS TORN LOOSE IN BLADING THE WEARING COURSE, IT IS NECESSARY TO GO BACK AND PATCH THE HOLE

On this project the initial priming operation, using MC-1 asphalt, was experimental and gave unsatisfactory results. The cotton, discolored by the asphalt, lay loosely upon the base, and there was no available asphalt in evidence to provide either bond or impermeability. Under these conditions, the value of the cotton might have been questionable and it is probable that it would have been a menace rather than a benefit. On this section the cotton and the sand cover were removed and the road was reprimed with MC-2 cutback asphalt. The cotton was then replaced and resanded. This asphalt proved satisfactory as it was absorbed by the base more slowly than the MC-1, and a correspondingly larger amount remained to be absorbed by the cotton.

Used as a prime coat without cotton, MC-2 cutback asphalt requires from three to ten days to cure, depending upon the weather and the base material. When used with cotton it is shut off from the sun and air and requires a considerably longer period to cure. The action of traffic and weather dries and hardens the surface of the asphalt-soaked sand sufficiently to form a film, which shuts out the air and retards the evaporation of the volatiles in the asphalt. The wearing course should not be placed until a satisfactory reduction of volatiles has taken place. The period of time required for this should be predetermined by experiment and laboratory analysis, and should be given consideration in determining the amount of construction time allowed in the contract.

The average time between the priming and the final spreading operations on this project was 35 days, which was sufficient for a satisfactory reduction of volatiles, but was not sufficient for thorough curing and drying of the asphalt. On all parts of the project the asphalt beneath and about the cotton was still sufficiently fluid at the end of the 35-day period to assure a rebonding to the base, under traffic and rolling of the wearing course and the seal coat, of all cotton torn loose from the base by the blading operations. If a thorough drying of this asphalt under and about the cotton had taken place preceding the final blading operations, the value of the cotton torn loose by blading would have been questionable. It is the writer's opinion that the slow curing of prime on a cotton fabric job is beneficial rather than harmful, where the wearing course is mixed on the road.

Weather plays an important part in cotton road construction. The asphalt work on the Magnolia-McNeil project was done during the hot days of a hot summer and it was found advisable to conduct the priming and cotton operations during the cooler hours of the day. Increasing the fluidity of the asphalt by heating to facilitate distribution at the nozzles increased its susceptibility to absorption into a gravel base low in clay content which had been heated by the sun to a temperature at times approaching or exceeding the maximum allowable temperature of the asphalt at the time of application. The best results were secured by applying the prime coat at as low a temperature as practicable for distribution, and before the base had become heated by the sun—and even with this procedure, immediate application of the cotton was essential in order to secure a proper distribution of asphalt between the cotton and the base.

It used to be the practice to place priming asphalt only on a dry base, but road builders have learned that a slightly damp surface assures a more efficient distribution of the prime coat. This is of particular value where cotton is placed on gravel that is low in clay content, the moisture retarding the ready absorption of the asphalt. A light shower is helpful, but showers seldom come when wanted and means should be available for sprinkling the base.

In the recent past, the stripping of all overburden lying above the base material in highway gravel pits was standard practice. It has been found, however, that top soil is of value in a base low in clay content, as it provides binding qualities without materially increasing the plasticity, and renders the base less absorbent. Gravel containing a large percentage of top soil was used on the north mile of this project where no cotton was placed, because of the limited supply, but top soil was not available for the rest of the road. No raveling of the base occurred at any part of the north mile, while some surface raveling did take place at a number of points where the top soil was lacking.

NEED FOR CARE IN BLADE GRADING

The wearing course on this project was blade mixed on the road, and this was the beginning of the difficulties with the cotton. In order to obtain a thorough mixing of all aggregate with the asphalt it was necessary to blade down to the cotton, with the result that a considerable amount of cotton was pulled loose from its bond with the base and approximately 5% was torn up in pieces ranging in size from a few square inches to several square yards. These fragments were removed from the road. This loss included that resulting from blading the mineral aggregate to reduce the moisture content preceding the application of the asphalt, and that from blading the mixed wearing course over a period of between 8 and 14 days to reduce the volatiles to the required maximum limit of 8% before the final spreading and rolling. Cotton torn loose from areas as large as those mentioned was always relaid.

It was planned at the beginning of the asphalt work to delay the placing of the cotton until after the initial prime coat had partially cured. This method was tried, but the loss of asphalt into the base was too great and the plan was abandoned at once. The best results were obtained when the cotton absorbed a portion of the initial prime coat, the second application completing the soaking of the cotton, with enough remaining to be blotted by the sand covering. Some of the sand, forced to the base between the meshes of the cotton by traffic, assisted in forming a homogeneous membrane of cotton, asphalt and sand, which provided the desired bond and impermeability—the prime object of using cotton fabric reinforcement. It is best that this membrane, once formed, be left undisturbed.

On jobs where the plasticity index of the base material is high, it would probably be found an advantage to delay the placing of the cotton until the first application of prime has had time to partially cure. If it is prac-

ticable to place the prime in half widths, curing would be hastened by leaving the cotton and prime coat exposed until curing is well advanced, then applying sufficient asphalt to take up the sand covering, which should be applied at once.

No difficulty was experienced in holding the cotton in place preceding the application of the sand cover coat. The asphalt in the initial prime coat held the strips in place sufficiently to resist the suction of the distributor wheels or the wheels of other slow-moving traffic. Tacking down of the edges or the use of additional asphalt for this purpose was not necessary except at the ends of strips.

The labor cost of laying the cotton was light; three men could unroll a strip 600 ft long, containing more than 400 sq yd, in about twenty minutes. The strips were unrolled in the desired position and, with the exception of the straightening out of occasional kinks, required little attention during the placing of the rest of the priming asphalt and the sand cover.

The wearing course was composed of 200 lb per sq yd of local crushed gravel of a maximum size of $1^1/_4$ in. and 1.20 gal of medium curing cutback asphalt No. 3. The wearing course was rolled and sealed with 25 lb per sq yd of pea gravel and 0.4 gal of MC-3 asphalt. The compacted thickness of the base was 8 in. Special shouldering material, high in plasticity, was used at the high sides of all superelevated curves to prevent the passage of moisture to the base.

A SMALL TEAR IN THE COTTON WILL SOMETIMES FORM A ROLL UNDER THE BLADE GRADER

Such Holes Are Patched Before Finishing the Wearing Course

It is apparent from these observations that the wearing course on a cotton-fabric job should be plant mixed. All operations should be planned with the object of avoiding any disturbance of the cotton. The compaction of mixed or partially mixed aggregate preceding the final spreading should be avoided. The loosening by blading of aggregate, mixed or unmixed, which becomes compacted on the cotton, is almost certain to result in the loss of some of the cotton.

Use of cotton in road building has been heralded as the opening of an important outlet for the principal money crop of the South, but this prospect is far from encouraging. If each state in the Union were to build an average of 100 miles of cotton highway each year, a total of 4,800 miles, the amount of cotton used would be approximately one fourth of 1% of the yearly crop. Cotton for highways will never be a boon to the cotton farmer, but it does offer possibilities in bituminous highway construction and maintenance that justify further extensive research and experimentation.

All the opinions stated and conclusions reached are those of the writer and not necessarily those of the Arkansas Highway Department.

Engineers' Notebook

Ingenious Suggestions and Practical Data Useful in the Solution of a Variety of Engineering Problems

Foundation Stresses in an Elastic Solid with a Rigid Underlying Boundary

By A. E. CUMMINGS, M. AM. SOC. C.E.

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IN many foundation problems it is necessary to determine the stress distribution in a bed of soil of finite depth overlying rock. It is well known that the Boussinesq equations for the stresses in a semi-infinite solid cannot be used for such a problem because the rock represents a discontinuity that is not taken into account in the Boussinesq analysis. Professor M. A. Biot has published (*Physics*, December 1935) an analysis of the stress distribution due to a point load applied to the surface of an elastic solid with a rigid underlying boundary.

When the surface load is distributed over a finite area, the effect of the rigid underlying boundary can be determined by the integration of Biot's point load equation. Figure 1 represents a surface load of intensity p_0 uniformly distributed over a circular bearing area of radius R. At some finite depth, d, below the surface, there is a bed of solid rock or other practically rigid material (q, r, s, t). The assumption is made that the overlying soil adheres perfectly to the rock surface and that the vertical and horizontal displacements at the rock surface are zero. It is further assumed that the value of Poisson's ratio for the soil overlying the rock is $^1/_2$.

In a cylindrical coordinate system, the load on the little element of area at the ground surface would be represented by

$$dP = p_0 \rho d\rho d\theta \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

If a point load, P, were acting at the location of this load element, the vertical normal stress, p_z, on the rock surface at the point A would be given by Biot's equation,

$$p_z = \frac{3P}{2\pi d^2}\left\{\frac{2}{\left[1+\left(\frac{\rho}{d}\right)^2\right]^{5/2}} - \frac{0.25}{\left[1+\left(\frac{\rho}{2d}\right)^2\right]^{5/2}} - 0.039\,\frac{1-3\left(\frac{\rho}{4d}\right)^2+\frac{3}{8}\left(\frac{\rho}{4d}\right)^4}{\left[1+\left(\frac{\rho}{4d}\right)^2\right]^{9/2}} - 0.154\,\frac{1-5\left(\frac{\rho}{3d}\right)^2+\frac{15}{8}\left(\frac{\rho}{3d}\right)^4}{\left[1+\left(\frac{\rho}{3d}\right)^2\right]^{11/2}}\right\} \quad \ldots\ldots (2)$$

The substitution of Eq. 1 into Eq. 2, and the integration of the resulting equation over the loaded area of radius R give the following value of p_z:

$$p_z = p_0\left\{1 - \frac{2}{\left[1+\left(\frac{R}{d}\right)^2\right]^{3/2}} + \frac{1}{\left[1+\left(\frac{R}{2d}\right)^2\right]^{3/2}} + \frac{0.234\left(\frac{R}{4d}\right)^4 - 0.935\left(\frac{R}{4d}\right)^2}{\left[1+\left(\frac{R}{4d}\right)^2\right]^{7/2}} + \frac{1.555\left(\frac{R}{3d}\right)^4 - 2.08\left(\frac{R}{3d}\right)^2}{\left[1+\left(\frac{R}{3d}\right)^2\right]^{9/2}}\right\} \quad \ldots\ldots\ldots\ldots (3)$$

Although Eq. 3 represents a rigorous solution of the problem, it is easily seen that numerical computation with such an equation would be a rather laborious process.

If the load in Fig. 1 were applied to the surface of a semi-infinite solid, the vertical normal stress, p_{z2}, on the vertical center line of the load at any depth, d, would be given by the equation,

$$p_{z2} = p_0\left\{1 - \frac{1}{\left[1+\left(\frac{R}{d}\right)^2\right]^{3/2}}\right\} \quad \ldots\ldots\ldots (4)$$

It is evident that numerical computation with Eq. 4 would be very much easier than with Eq. 3. Karl Terzaghi, M. Am. Soc. C.E., has suggested (*Oesterreichischen Bauzeitung*, June 18, 1932) that the effect of the rigid underlying boundary could be taken into account by the use of a depth reduction factor in Eq. 4, although he did not determine the numerical value of this factor. Instead of the full depth, d, from the ground surface to the rock surface, the stress calculation would be made with a fictitious depth, which would be smaller than d.

It is readily demonstrated that the use of $0.75d$ instead of d in Eq. 4 will lead to the same result as will be obtained with Eq. 3, or p_z and p_{z2} will be equal. In other words, the effect of the rigid underlying boundary can be taken into account, as Terzaghi suggested, by the use of a fictitious reduced depth in the stress equations for the semi-infinite solid. This is shown graphically in Fig. 2, where stress distribution curves are plotted with Eqs. 3 and 4 and with Eq. 4 modified by the substitution of $0.75d$ for d.

It should be noted that there is very little difference between the curve for Eq. 3, which is the rigorous solution, and the curve for the modified Eq. 4, which is an approximate solution involving a depth-reduction factor. It should also be noted that the stresses given by Eq. 3 and by the modified Eq. 4 are greater than the stresses given by Eq. 4 which refers to the semi-infinite solid. In other words, the rigid underlying boundary has the effect of concentrating the stresses.

Figure 2 also shows a curve plotted from the equation,

$$p_{z3} = p_0(1 - \cos^n \alpha) \quad \ldots\ldots\ldots\ldots (5)$$

Wherein n is the Griffith-Froehlich concentration factor, and α is the half-angle of opening of a right circular cone whose apex is at the point A in Fig. 1, and whose base is the loaded area. The curve is plotted for a value of $n = 5$.

The close agreement between the curve of Eq. 5 and the curves of Eq. 3 and the modified Eq. 4 provides a clear

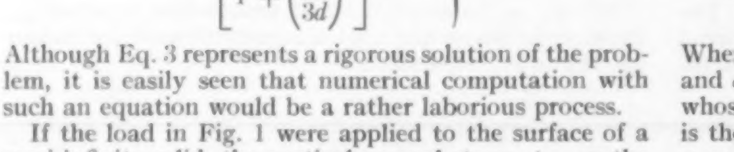

FIG. 1. SURFACE LOAD UNIFORMLY DISTRIBUTED OVER A CIRCULAR BEARING AREA

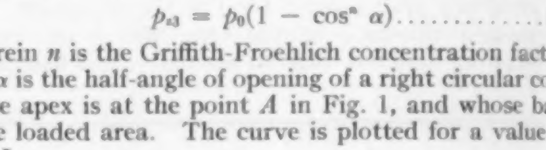

FIG. 2. STRESS DISTRIBUTION CURVES PLOTTED WITH EQS. 3, 4, AND 5

indication of the physical significance of the concentration factor. The original derivation of the equations involving the concentration factor was made for the purpose of checking certain experiments on stress distribution through sand beds. In all these experiments the pressure measuring devices were placed on the rigid floor of the laboratory. The measured pressures were not those that could be expected in a semi-infinite body. They were the pressures at the rigid underlying boundary of a sand bed of finite thickness. The experiments approximated the condition of Fig. 1, with the rigid laboratory floor taking the place of the underlying rock. The stress concentration factor is therefore nothing more than a boundary effect. The possibility of this was suggested by the writer some time ago (Transactions Am. Soc. C.E., 1936, p. 1133), and the idea of a depth reduction factor was suggested at the same time by N. M. Newmark, Assoc. M. Am. Soc. C.E.

Although the equations given here refer only to the uniformly distributed surface load, the Biot point load equation can be integrated for other types of nonuniform surface loads. When this is done, the results obtained are similar to those here given and they lead to similar conclusions. It should be kept in mind that these equations give the stresses at the rock surface only. On the basis of St. Venant's principle, it could be expected that the stresses in the region above the rock would approach the values of the stresses in the semi-infinite solid. It is also to be expected that the stress concentrating effect of the rigid boundary would disappear entirely at large distances above the rock surface.

Concrete Cylinders for Temporary Construction Trestles

By Kenneth C. Cox, Jun. Am. Soc. C.E.

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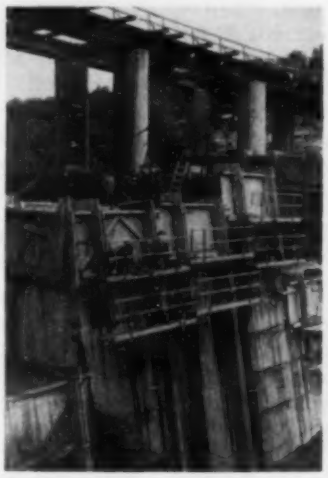
Placement of concrete at Mahoning Dam, near Dayton, Pa., was accomplished by the construction of a number of temporary trestles. The type used is illustrated in the accompanying photographs.

In order to place economically 346,000 cu yd of concrete in a structure whose maximum length and width were, respectively, 970 and 330 ft, a system of temporary bridges had to be planned. Concrete cylinders 6 ft in diameter were found to serve effectively as bents. Pairs of cylinders were placed 14 ft center to center, each to carry two 24-in., wide-flange, 130-lb beams placed at 2-ft centers. The span between each pair of cylinders was usually made 40 ft to fit in with monoliths 40 ft wide. Each pair of beams was bolted together by pairs of rod bolts 1 in. in diameter and two plates $^1/_2$ in. by 3 in. by 2 ft 5 in., spaced approximately 10 ft apart. Wooden diaphragms of 6-in. timber were placed between the beams at these points.

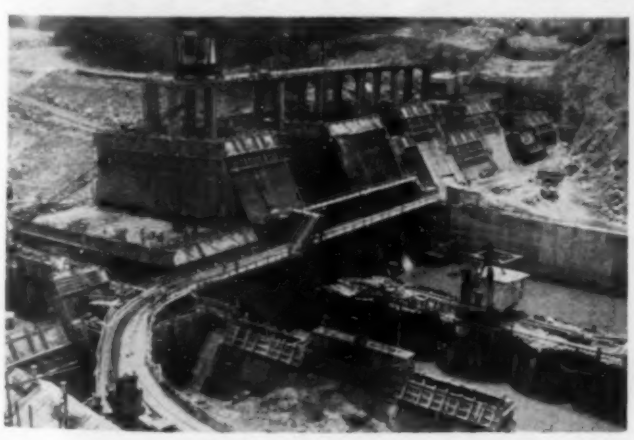


Concrete Columns Become Part of Permanent Structure After Supporting Temporary Trestle

To hold the beams firmly to the top of the cylinders, four anchor bolts 1 in. in diameter were embedded to bolt to the bottom flange of the beams while two longer anchor bolts extended far enough above the top of the beams to bolt fast to a long tie supported by the two pairs of beams. Between the beam assemblies, approximately 10 to 12 ft apart, were bolted steel diaphragms usually made of steel pile sections. They reduced vibration and the tendency of the beams to roll.

Ties were laid across the top of the beams to support 130-lb rails, which carried standard whirler cranes having a 14-ft gage. Openings were made between the track by using short and long ties. The openings, which had to be large enough to admit a 2-cu yd concrete bucket, were ordinarily 10 ft 8 in. by 9 ft. The entire assembly of ties and rails was such that it required a minimum of labor to break it up into large units for relocation.

Cylinders were made by filling steel forms with concrete. The forms were built in two sections of $^1/_4$-in. steel plates bolted together to form a cylinder 6 ft in diameter. A 24-ft lift could be poured with these forms. Any height could be obtained by successively raising the form and pouring a new lift. This was easily accomplished by loosening the bolts holding the form segments



Concrete Being Poured from Cranes on Trestle Supported by Concrete Columns, Mahoning Dam

When Concrete Reached Under Side of Trestle, Trestle Sections Were Removed and Concrete Columns Lengthened

together and retightening them after the form was raised. Enough lap was allowed at the bottom of the form to hold it firmly in place. Guy wires were attached to the top of the form at several places to keep it plumb while the concrete was being poured.

The concrete cylinders were placed in such locations that they would not interfere with any parts of the final structure, and they became an integral part of the mass concrete of the dam. Cylinders up to 30 ft high were placed using no reinforcing, but higher ones were reinforced. One set of cylinders was approximately 60 ft high. These were reinforced by welding sway bracing to the steel forms, which were then left in place at the last pour.

When the concrete reached the under side of the trestle beams, the trestle was broken into large units and set aside. The cylinders were then extended to a new stage and the beam and tie assemblies replaced.

Staining Natural River Sands for Studies of Sediment Movement

By RICHARD G. GRASSY

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CERTAIN investigations of the movement of bed sediment in hydraulic models and small streams may be greatly facilitated by the introduction or emplacement of colored sands having the same physical and hydraulic properties as the material in the bed of the model or stream. In movable-bed hydraulic models, colored sands are of value in tracing the movement of bed sediment from its point of scour to its point of deposition. To obtain measurements on the depth of scour occurring during a flood on a small natural stream, colored sands may be used to refill holes bored into the bed during low water; and by accurately referencing the location of the holes to fixed points on the bank, excavation to the top of the undisturbed colored sand after a flood permits the determination of the maximum depth of scour during the period of high water. Under some conditions, the distance of sand movement may be determined by tracing the colored sand downstream.

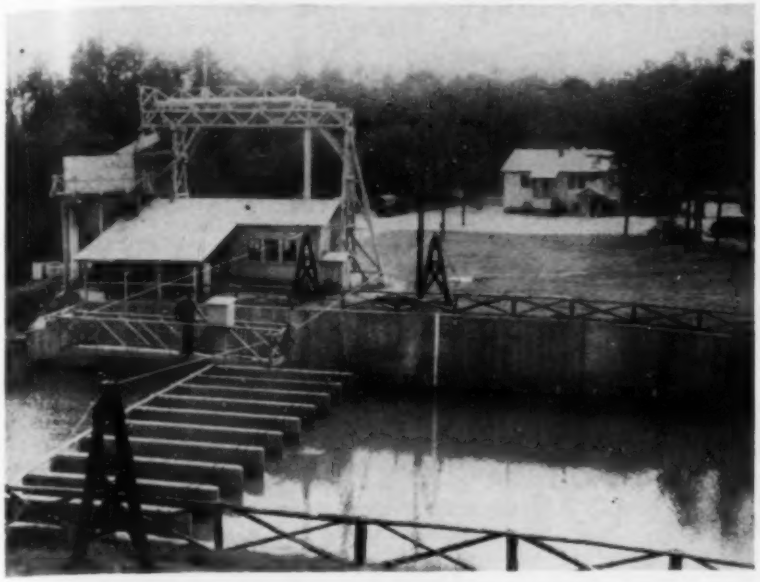
In order that the colored sands introduced may have the same physical and hydraulic characteristics as those of the transported bed material, it has been found convenient to stain, by the use of dyes, a small portion of this bed material. An investigation of the process of staining natural river sand has been made by the Soil Conservation Service sediment-load laboratory on the Enoree River near Greenville, S.C., to determine (1) the most effective and economical concentration of dye solution to be used, (2) the length of soaking time necessary for maximum adsorption of the dye, and (3) the permanence of the stain under prolonged exposure to natural stream waters. (A general article on studies at this laboratory, by Gilbert C. Dobson, M. Am. Soc. C.E., and Joe W. Johnson, Assoc. M. Am. Soc. C.E., appeared in CIVIL ENGINEERING for February 1940.)

Preliminary experiments showed that a methyl violet dye, procurable at any pharmacy, was effective in staining sand. (DuPont Methyl Violet NE, No. 6588, was used in these experiments. Because the dye is toxic, caution should be exercised in its use and in the disposal of waste solutions.)

The procedure was to place in 600-ml beakers 5 samples of Enoree River sand (predominantly quartz), each sample weighing approximately 200 grams, the size of the particles ranging in diameter from 0.701 to 0.991 mm. Portions of dye, each weighing 2.000, 1.000, 0.500, 0.250, and 0.125 grams, respectively, were placed in small beakers and dissolved in 95 proof commercial-grade alcohol, 15 ml of alcohol being used for the 2.000-

AN EXPERIMENT TO TEST BED CHANGES BY MEANS OF STAINED SAND
(Left) Gully Across Which Test Trench Was Dug, (Center) Trench from Which Sand Was Removed and Replaced After Staining, (Right) Same Trench Five Months Later, with Deposits Removed to Show Depth of Scour—Note Permanence of Stain

gram sample and 10 ml for each of the others. The dye solutions were then diluted to 100 ml with distilled water and added to the beakers containing the 5 samples of sand. The sand samples were allowed to remain in the dye solutions for a half hour, with occasional stirring. The dye solutions were then decanted and the sands washed with tap water on a 250-mesh sieve until no color showed in the wash water. The dyed sands were next transferred to large watch glasses and air dried.



ENOREE RIVER CONTROL, WHERE SAMPLES OF STAINED SAND WERE EXPOSED IN NATURAL STREAM WATERS

The same staining procedure was then repeated on other sand samples using the same dye concentrations but with soaking periods of 1, 2, 4, 8, and 24 hours, giving a total of 30 samples of stained sand.

After drying, the stained samples were transferred to sheet-metal cylinders, $8^1/_2$ in. long by $1^1/_8$ in. in diameter, the ends of which were closed by means of one-hole rubber stoppers. To decrease the possibility of losing the sand and yet permit water to pass slowly through the cylinders, a loose wad of cotton waste was placed between the sand and the rubber stoppers. The cylinders were then securely fastened side by side to the concrete bottom of the control section in the Enoree River. These cylinders, with their axes parallel to the direction of stream flow, were completely immersed at all times.

Small portions of the samples were removed at the end of exposure periods of 24 hours, 1 week, and 1, 2, 3, 4, 5, 6, and 7 months. The portions removed were air dried and transferred to glass vials for comparison.

By visually comparing the various samples, the following conclusions were reached: When samples soaked for an equal length of time in the dye solutions were compared, there was only a slight difference in the initial color produced by any of the dye concentrations ranging from 2.00 to 0.25%, but with a dye concentration of 0.125% the initial color was decidedly lighter. As the time of immersion in the river increased, all samples became lighter in color; however, even after 6 months of exposure there seemed to be no appreciable difference in color between samples stained with 1% and 2% concentrations. The lower concentrations yielded a somewhat lighter color after 6 months of immersion. In summarizing, it may be stated that, for equal time of soaking in the dye solutions, the color intensity of the stained sediment varied directly with the concentration of the dye solution, but that the results of immersion in the stream indicated that the use of concentrations in excess of 1% served no useful purpose within the conditions existing in these tests.

In comparing the initial color of the stained sand for differences due to variation in time of soaking in the dye solutions, there appeared to be no appreciable difference for any given dye concentration in varying the staining time from one-half to 24 hours; and after 6 months' immersion in the river, sands stained with a particular dye concentration had approximately the same color intensity regardless of initial staining time.

Thus it may be concluded that for conditions similar to those under which these experiments were conducted, a noticeable range in intensity and permanency of color may be obtained by varying the concentration of the dye solution and time of staining. This range in intensity, however, is not great enough to permit the identification of grains dyed to different shades of this color in the same experiment. The particular concentration and soaking time chosen will depend upon field conditions, and the intensity and permanency of color desired. For most conditions, a dye concentration of 1% and a soaking time of one hour appear to give the optimum in permanency and intensity of color for the lowest cost and least time of preparation. It should be noted that the stain is not permanent in the presence of a strong acid or a strong base and is more easily destroyed by acid solutions than by basic.

A Simplified Method for Calculating Deflections of Beams

By EDWARD SAIBEL

ASSISTANT PROFESSOR, DEPARTMENT OF MECHANICS, CARNEGIE INSTITUTE OF TECHNOLOGY, PITTSBURGH, PA.

THE three-moment equation involves not only the moments at any three points of the elastic curve of a beam, but also the relative vertical distances between the points. It is an equation which is valid for statically determinate as well as for statically indeterminate beams. The use of the equation has hitherto been restricted to the solution for the bending moments at the supports of a continuous beam. In recent years it has been superseded, to a large degree, by other methods, particularly by the method of moment distribution. Regardless of how the moments at the points of support have been found, the equation can be used in many cases to simplify calculations for the deflections of beams, both statically determinate and indeterminate. Although the method will handle all cases, in those cases where the elastic curve has a zero slope at a known point, the deflection is calculated most easily by the area-moment or slope-deflection method. In all other cases, however, the writer recommends the procedure to be described in the following paragraphs.

When the bending moments at the three points have been found by any method, and the vertical positions of two of the points are known, the only unknown in the three-moment equation is the vertical position of the third point, or its deflection relative to the other two.

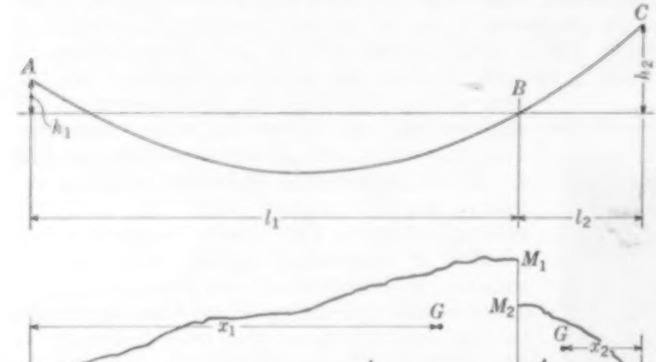


FIG. 1. NOMENCLATURE FOR THREE-MOMENT EQUATION AS GIVEN BY RIGGS AND FROCHT

Thus, in those problems where the supports are on known levels, two of the points involved in the three-moment equation are taken to be consecutive points of support, and the third point, the point between supports at which the deflection is to be found. A similar procedure gives the deflection at the end of an overhanging beam.

The three-moment equation as given by Riggs and Frocht in their *Strength of Materials* is

$$M_Al_1 + 2M_B(l_1 + l_2) + M_Cl_2 - 2M_1l_1 - 2M_2l_2 + 6\left(\frac{A_1x_1}{l_1} + \frac{A_2x_2}{l_2}\right) = 6EI\left(\frac{h_1}{l_1} + \frac{h_2}{l_2}\right)$$

where A, B, and C are any three points on the elastic curve. This form is applicable to the deflection problem even when the spans have different moments of inertia,

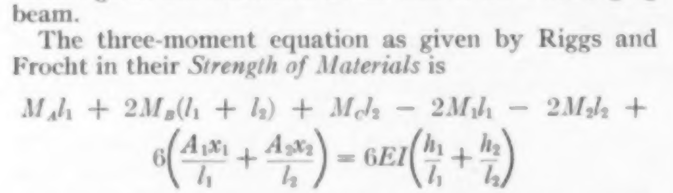


FIG. 2. LOADING AND DEFLECTION TO ILLUSTRATE EXAMPLES 1 AND 2

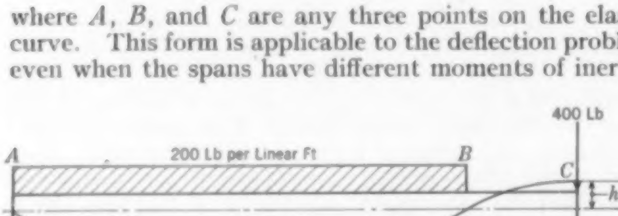


FIG. 3. MOMENT DIAGRAM FOR LOADING SHOWN IN FIG. 2 (EXAMPLE 1)

since for our purpose one span alone is considered. The nomenclature is shown in Fig. 1. It should be noticed that only the bending moment curves due to the loads on the beam between A and B, and between C and B are drawn, both being drawn toward B. The sign convention used has been to take downward loads either to the left or right of B as producing negative moments at B; also, h_1 and h_2 are to be taken as positive when A and C are above B. The following examples illustrate the use of the method:

Example 1. Figs. 2 and 3. To find the deflection at the right end,

$$\begin{array}{lll} M_A = 0 & M_2 = -1{,}200 & l_1 = 12 \\ M_B = -1{,}200 & A_1 = -57{,}600 & l_2 = 3 \\ M_C = 0 & A_2 = -1{,}800 & h_1 = 0 \\ M_1 = -14{,}400 & x_1 = 9 & h_2 = \delta_1 \\ & x_2 = 2 & \end{array}$$

Substituting into the three-moment equation we find $\delta_1 = 0.225$ in.

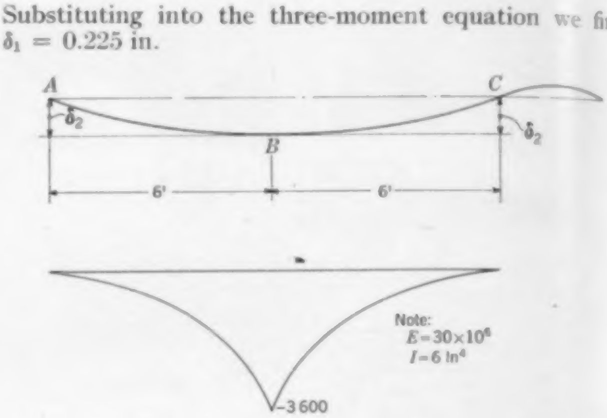


FIG. 4. DEFLECTION AND MOMENT DIAGRAM FOR LOADING SHOWN IN FIG. 2 (EXAMPLE 2)

Example 2. Figs. 2 and 4. For the same beam, to find the deflection midway between the points of support, we find $\delta_2 = 0.415$ in., from

$$\begin{array}{ll} M_A = 0 & A^1 = A_2 = -7{,}200 \\ M_B = 3{,}000 & x_1 = x_2 = 4.5 \\ M_C = -1{,}200 & l_1 = l_2 = 6 \\ M_1 = M_2 = -3{,}600 & h_1 = h_2 = \delta_2 \end{array}$$

Example 3. Fig. 5. To find the deflection at point B of the continuous beam shown, the suports being on the same level, we have

$$\begin{array}{ll} M_A = -1{,}860 & \dfrac{A_1x_1}{l_1} = -3{,}200 \\ M_B = 1{,}640 & \\ M_C = -1{,}200 & \dfrac{A_2x_2}{l_2} = -480 \\ M_1 = -3{,}200 & \\ M_2 = -800 & \\ l_1 = 4 & h_1 = h_2 = \delta_B \\ l_2 = 5 & \text{giving } \delta_B = 0.0146 \text{ in.} \end{array}$$

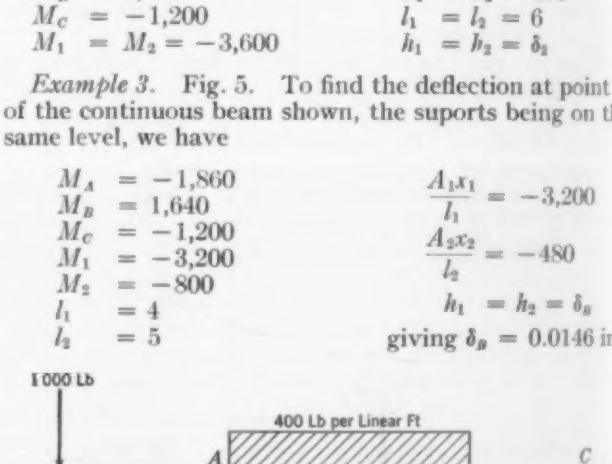


FIG. 5. DEFLECTION AND MOMENT DIAGRAM FOR LOADING IN EXAMPLE 3

OUR READERS SAY—

In Comment on Papers, Society Affairs, and Related Professional Interests

Model Tests on Hydraulic Structures

To the Editor: The article by E. R. Dodge on "Verification of Drop-Inlet Hydraulic-Model Studies by Field Tests," in the August issue, is particularly interesting to the writer who has recently completed model tests on a similar structure. The results of these tests bring out points not mentioned by Mr. Dodge.

The tests were made on a one-tenth size model of the structure shown in the accompanying Fig. 1. The principal difference between this structure and the one tested by Mr. Dodge is that the barrel is on a $6^2/_3$% slope. Ordinarily the barrel is placed on a slope never steeper than the slope of the hydraulic grade line. Such is not the case in the model tests described here, but this does not vitiate the comparisons to be made, even though it modifies them.

A piezometer was placed on the downstream wall of the model riser at the point indicated in Fig. 1, and the pressure head at this point was recorded for 39 of the 57 tests made at various flows. Data also obtained during each test included the head on the inlet lip, the discharge, and notes concerning the flow conditions in the inlet, riser, and barrel. The results of these tests are shown in the accompanying Fig. 2.

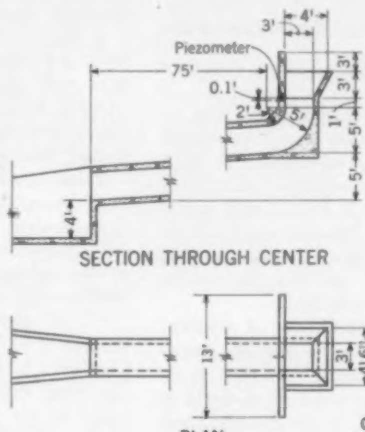


Fig. 1. Drop Inlet on Which Model Tests Were Made

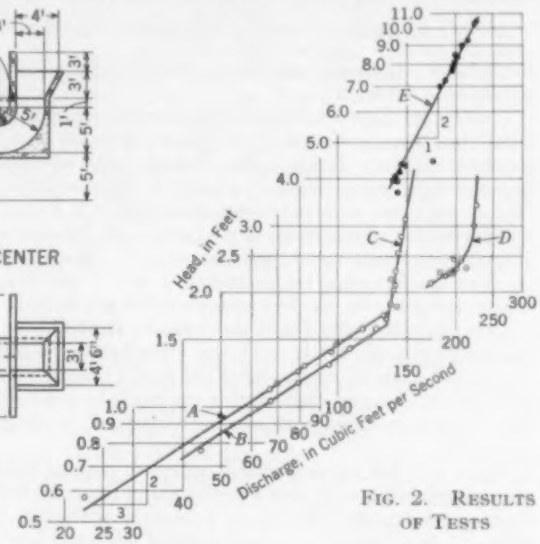


Fig. 2. Results of Tests

Much interesting information can be gleaned from a study of Fig. 2. The slopes of Curves *A* and *B* are 2 on 3, or the slope of a rectangular weir rating curve. This is also the slope of the left portion of the curve shown in Mr. Dodge's Fig. 2. The presence of the two curves, in the writer's Fig. 2, is believed to be due to differences in the shape of the nappe at the lip. The riser, the barrel, and the inlet were partly full when the data plotted on Curves *A* and *B* were obtained. For Curve *C* the riser and inlet were full, but the barrel was only partly full. The steep slope for Curve *C* indicates that orifice flow conditions exist. For Curve *D* both the riser and barrel were flowing full. The lower end of Curve *D*, an extension of Curve *A*, indicates that weir flow is again existent. This is because the added suction head, after the barrel flows full, sucks the water out of the inlet, and the inlet is only partly full. As the discharge increases the inlet fills, and the upper end of Curve *D* indicates that orifice or pipe flow again controls the discharge.

That it is really orifice or pipe-flow conditions that control the discharge for Curves *C* and *D* is shown by the replot of the data for these curves along Curve *E*, which has a slope of 2 on 1. The net head (the headwater elevation minus the elevation of the water surface in a manometer connected to the piezometer) is used in plotting the data along Curve *E*. It is interesting to note that the points plotted along the lower part of Curve *D* (weir flow) also plot along Curve *E* (orifice flow) when the proper head corrections are made.

The data presented here show that weir-flow conditions exist until the riser flows full, and that orifice or pipe-flow conditions exist after the riser flows full even though air may be sucked in with the water. It is not possible to determine the dividing point accurately by observing the flow conditions at the inlet. Recourse must be had to the head-discharge curve.

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U.S. Soil Conservation Service,
St. Anthony Falls Hydraulic Laboratory

Minneapolis, Minn.

From the Discusser's Viewpoint

To the Editor: For the first 21 years after I was honored by being admitted to the Society, deafness prevented my taking part in oral discussions. Then in 1909 I started using acousticons.

About that time I told the Secretary, Mr. Hunt, that I had attended more meetings than most of our members. He surprised me by saying: "You have not attended any; you always sit in the Reading Room until after the meeting and then join the crowd."

From 1911 to 1914 frequently I would be the only member of the Board of Direction present at the bi-monthly meetings, and therefore would have to preside. It was noticeable that often a good paper would be read without bringing out any discussion. Then, after adjournment, some members would complain about the stupid meeting, meanwhile mentioning a lot of interesting aspects of the subject.

Why, I would ask, had they not made those statements from the floor, as that was the very information we all wanted to hear.

Finally, as an upshot of such experiences, I made up my mind to take part in the discussion of the next ten papers—whether in my line of work or not. In so doing, I explained that doubtless when they heard me discuss these papers, they would say, "Good Heavens, I can do better than that myself." And they have.

All this has had an interesting aftermath—now, I can hardly attend any meeting, anywhere, on any subject, without seeing an opportunity to offer comments and feeling the impulse to do so.

New York, N.Y. T. Kennard Thomson, M. Am. Soc. C.E.

Time Required for Saturation of Earth Dam

Dear Sir: The following letter is in the nature of a response to discussions of my article on "Time Required to Saturate an Earth Dam," which was published in the April issue of Civil Engineering.

In the July issue, D. F. Peterson raises a question regarding Eq. 2 in my article. He states "Equation 2 must satisfy more boundary conditions than Mr. Karpoff mentions." For the correctness of this equation see "Technical Memorandum No. 383," U.S. Bureau of Reclamation, page 13. Mr. Peterson also mentioned that equations

$$\frac{1}{2}h^2 = \frac{qs}{k} + \frac{1}{2}a_0^2 \text{ and } q = ka_0 \tan \phi$$

"are sufficient to determine q, a_0, and the position of the line of saturation. . ." There are four unknowns in these equations, and

solution is possible only when a_0 is determined. (See Technical Memorandum No. 383, page 48, Table 8, and par. 14, page 46.)

In the case of the vertical discharge slope mentioned by Mr. Peterson, Angle ϕ is determined by the prolongation of an imaginary line, lying in the same direction as the outflow force and tangential to the line of saturation at point M.

A properly designed earth dam has its downstream slope coincident with direction of outflow force—that is, tangential at point M (see Terzaghi's *Erdbaumechanik auf Codenphysikalisher Grundlage*, 1925, pp. 128–131, and 159, Formula 56).

In the same issue R. C. Miller states that application of Dupuit's formula gives very close results for certain steady flow conditions. In my article Dupuit's formula was used for derivation of the equation of the theoretical line of saturation only.

Darcy's formula, $V = K\frac{h'}{x}$, was used in the derivation of the formula for the time of saturation in which K and h' are constant values and X varied.

Concerning Captain Miller's experiments with porous media, no details are given so I am at a loss to know whether or not results are applicable to my article. The tested material should be well graded, of optimum moisture content, placed on an impervious foundation one layer at a time (not exceeding 3 in.), and each layer compacted by standard methods (see R. R. Proctor's method in *Engineering Properties of Soil*, Chapter 12). If the tested material satisfies the foregoing requirements, I fail to see why the results would deviate from the ones anticipated in my article.

Captain Miller also states that, due to the influence of gravity, the water in voids tends to fill the voids below the line of saturation before there is water behind the dam. I agree with this statement if it is assumed that, during the construction period, earth is used with a percentage of compaction water much greater than optimum.

Tight soils having properties tending to trap excessive amounts of air in the voids will have a coefficient of permeability K varying from approximately 1.00 to 0.10 ft per year at the consolidated dry density. It is clear that K is dependent upon the type of material used, and also that it is predetermined by laboratory examinations prior to and during construction work.

In the August issue H. R. Cedergren states "Mr. Karpoff has based his method upon conditions existing after the completion of saturation." This is not a correct interpretation, as my Eq. 6 represents the summation of the increment time and distance covered by the variable velocities between the limits. Therefore it represents the line of saturation just before the seepage flow begins but not after the completion of saturation.

KONSTANTINE P. KARPOFF

Grants Pass, Ore.

Comments on Airplane Impact Loads on Buried Pipe

TO THE EDITOR: In the September issue, Robert G. Scott, Assoc. M. Am. Soc. C.E., presents a solution for "Airplane Impact Loads on Buried Pipe." I wish to take exception to his conclusions on four principal points.

1. As a basis for computations, he assumes a plane weighing 52,000 lb with dual tires 42 by 15.50. For the design of pavements, the Civil Aeronautics Administration requires a 60,000-lb plane for a Class 3 airport and a 100,000-lb plane for a Class 4 airport. Therefore, if the loads shown in Mr. Scott's Table I were correct for a 52,000-lb plane, the answer could not be used in designing Class 3 and Class 4 airport drains. Most airports—either new projects, or those proposed to be enlarged—are aimed toward at least Class 3.

Dual tires are not being used on the Army and Navy planes, nor is it believed that they are contemplated. For commercial planes, likewise, the trend seems to be toward single tires. Therefore, all such computations should be based on single tires.

2. In the formula, vertical deceleration, $A_v = \frac{V^2}{2S}$, Mr. Scott assumes that $S = 28$ in. which is obtained by the sum of $19^1/_2$ in. for shock absorber travel and $8^1/_2$ in. for tire flattening (deflection). If we disregard the questionable application of formulas for free-falling bodies to this problem and the doubt of the existence of a shock absorber having a travel of $19^1/_2$ in., the tire deflection of $8^1/_2$ in. disproves the author's computations.

The 42 by 15.50-in. tire assumed by Mr. Scott is known as a low-pressure tire. Its pneumatic throw (100% deflection) is 12 in. Specifications for this type of tire require that it support the static load with not more than 35% deflection or only 4.2 in. From an analysis of government laboratory test data on this type of tire, a load of at least $2^1/_4$ times static load, or 29,250 lb, is required to cause a deflection of $8^1/_2$ in., instead of 11,300 lb by the author's calculations.

3. The author finds a lesser impact tire load (11,300 lb) than static load (13,000 lb), and then he states the impact footprint area can be three times the area under static load. He disregards the fact that increased footprint area is caused by increased deflection which in turn can be caused by nothing but increased tire load.

A scaled drawing of a 42 by 15.50 tire shows that the footprint area can increase approximately three times the static footprint area only when the tire deflects down to the rim. According to "Design of Airport Runways," issued by the U.S. War Department Corps of Engineers, in January 1941, this cannot occur "until the impact load reaches 3.5 to 4.0 times the static load."

There is a definite relationship between tire load, tire deflection, pressure on the landing surface, and footprint area for each type of tire when the inflation pressure for static load is in accordance with the recommendations of the tire manufacturer. Any statements or assumptions producing results that deviate materially from this relationship are out of line.

4. In computing the impact loads in Table I, only one of the dual tires was considered. Computations show for a 5-ft cover, the load on a 12-in. pipe from the off-tire is 40% of the load from the tire over the pipe. This is based on a clearance between tires equal to the greatest width of the tire. While the percentage of load transmitted from the off-tire reduces with a decreased cover, there is no justification in omitting such load from the computations.

H. E. COTTON, M. Am. Soc. C.E.

Middletown, Ohio

Use of Microfilm Technique in Reproduction of Technical Articles

TO THE EDITOR: During the past two years the American Mathematical Society has sponsored a program of development of a microfilm reading machine for individual use. As a result there is now obtainable an excellent individual reading machine at a cost (approximately $32) which many individuals and engineering offices can afford. During the past year the American Mathematical Society has distributed approximately 500 of these reading machines free to persons who purchased a three-year subscription to *Mathematical Reviews*, a journal of mathematical abstracts now in its second year of publication.

It seems quite logical to me that the development of microfilm technique and the introduction of such new journals should go hand in hand. Each supplements the usefulness of the other. Both have their greatest usefulness for those of us who do not have excellent library facilities available. Let me illustrate with an example. In *Mathematical Reviews* I may read the abstract of an article dealing with elastic plate theory. The original article is 10 pages long, and I decide that I would like to read it. It is published in a journal which is not available to me. I may obtain a copy of this article on microfilm from Brown University through the American Mathematical Society at a cost of 10 cents (price 1 cent per page). If I were to order a photostatic copy of this same article from the Engineering Societies Library, which has been the common practice in the past, I would pay $2.50 (price 25 cents per page). Note the amazing difference in cost of the two methods of reproduction.

It would be timely for the appearance of an article in CIVIL ENGINEERING on the subject of microfilm technique by someone who is particularly interested in photography. An excellent discussion of the economics of the matter by Atherton Seidell appears in *Science*, Vol. 94, August 1, 1941, page 114.

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Assistant Engineer,
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Vicksburg, Miss.

SOCIETY AFFAIRS

Official and Semi-Official

Chicago Sponsors Fall Meeting

Outstanding Program in Every Respect Characterizes Sessions, October 15 to 18, 1941

At the opening event of the Society's Fall Meeting, Chicago, the host city, was pictured as the "crossroads of the Middle West." It lived up to this reputation in a number of respects. First it drew a representative attendance from far and wide—quite considerably due, doubtless, to its central location and cosmopolitan interests. Then it presented a varied technical program, built largely around defense activities, but also dealing with many far-flung interests of the profession centering about such a metropolis. Finally, it was characterized by great proficiency in caring for the entertainment and social needs of its throng of visitors.

Something Different in Meetings

In spite of the fact that every Society meeting is arranged around the same basic framework, each differs from the others in minor or major aspects. The problem in Chicago was to accommodate three difficult requirements—to provide the equivalent of one and a half full days of papers on war activities, to give another full day for a total of eight Division sessions, and at the same time to leave at least another day and a half for inspection trips, all in a total of three and a half days!

Actually the program was so arranged as to do even better than this, for an additional three-hour engineering trip was sandwiched in the middle of the day on Thursday. It all took thoughtful planning, but everything worked out to the genuine enjoyment and satisfaction of all present—the engineers, their families, and friends.

To meet this program the time schedule was adjusted to reserve all Wednesday as well as Thursday until noon, for defense meetings. Then came a train trip to the Chicago Bridge and Iron Company and return completed about three o'clock. Here the Divisions took over, with sessions for the remainder of the afternoon and on Friday morning. Chartered buses left the Palmer House, meeting headquarters, all during Friday morning for the all-day inspection trip including lunch and dinner. Other shorter trips on Saturday morning rounded out the inspection program.

War Activities Especially

Promptly at 10 o'clock on Wednesday morning, October 15, the Fall Meeting got under way. After exchange of courtesies between the local and Society officials, the remainder of the morning was devoted to papers outlining engineering problems in the great Chicago area and the extensive provision for their solution. A single large topic also occupied the afternoon general session; three speakers addressed themselves to "National Defense Construction," as viewed from the angles of cantonment building, naval construction by the Bureau of Yards and Docks, and the war work of the Corps of Engineers.

Still a third general subject, Civilian Protection in War Time, was allotted a full session without competition of other matters. This was on Thursday morning. Four phases were covered by as many speakers and, in addition, a colored motion picture showed the bombing of Chunking, China.

Technical Sessions Also Provided

On both Thursday afternoon and Friday morning four Technical Divisions held simultaneous sessions. Two gatherings were sponsored by the Soil Mechanics and Sanitary Engineering groups and one each by the Highway, Waterways, and City Planning Divisions, while the other was planned by the Structural and Construction Divisions jointly. No attempt will be made to describe these Division meetings in detail, because it is hoped that many of the papers presented may be arranged for general distribution later in Society publications.

Largest of the social gatherings was a luncheon on Wednesday noon between the general Society sessions. This was in joint charge of the Society and the Association of Commerce of Chicago. An attendance of about 900 taxed the capacity of the Grand Ballroom. All listened enthusiastically while Gen. Brehon B. Somervell, M. Am. Soc. C.E., gave an enlightening address on defense construction.

Complimentary Lunch and Inspection

The following noon about 400 engineers left the LaSalle Street Station by special train for suburban Washington Heights, as guests of the Chicago Bridge and Iron Company. A fine lunch was ready upon arrival, and about a hundred members of the office staff joined in formally opening the building where the repast was served. This unique building has a circular room, 80 ft in diameter, covered by a domed roof formed of $^3/_{16}$-in. plates smoothly welded into a harmonious whole. Inspection of various operations in the extensive shops of the company followed, before the train left for the return trip at 2:30.

Only one formal social event was scheduled—the dinner dance on Wednesday evening. From the standpoints of food, music, dancing, and companionship, this affair was a most notable success. For the student members, an added attraction was the bright idea of the local committee in securing many girl students from neighboring colleges as dinner partners. It goes without saying that the younger group was largely represented and had a splendid time.

On the following evening an entirely different type of program was presented. Informality was the keynote. A smoker with light refreshments formed the basis of the evening, supplemented by a floor show of dancing, singing, legerdemain, and acrobatics. This popular event was concluded by a period of social dancing.

Other Meetings Arranged

In addition to the main events a number of attendant gatherings, both regular and special, were provided for. Committees of the Society, the Board, and the Divisions met at various times beginning on Sunday, October 12, and running throughout the week. Board sessions were held both Monday and Tuesday. The regular Local Sections Conference convened on Tuesday with sessions in the forenoon and afternoon, as well as a lunch in conjunction with the Board members. Another regular event was the Student Chapter Conference; it held its own meetings both Wednesday and Thursday mornings, with a lunch on Thursday, followed by a subway inspection trip.

One of the many thoughtful arrangements of the local committee

E. B. Black—Presidential Nominee for 1942

THIS year, at its meeting in Chicago on October 13, the Society's Nominating Committee cast a unanimous vote for Ernest Bateman Black, of Kansas City, Mo., as Official Nominee for President for 1942. He has accepted.

For years Mr. Black has been prominent in civil engineering circles and widely known in the Society. Since 1915, he has been senior partner in the firm of Black and Veatch. The firm's work has covered the general municipal field, but specializing in water supply, sanitation, power, and valuation.

In the Society Mr. Black has been a loyal and useful member. He has served on numerous committees and is now chairman of the executive committee of the Engineering Economics Division. From 1932 to 1934 he was a Director.

Mr. Black's high personal and professional character, his friendly personality, and his deep affection for the Society are ideal qualifications for a President of the Society. A later issue will contain a more comprehensive review of his career.

resulted in a dinner on Monday evening at the headquarters hotel, to introduce Board members and ladies to their Chicago hosts. All former Board members within reach were invited and many attended, to enjoy again the company of old associates in Society work. The atmosphere was one of reunion, in which the ladies took a prominent part.

All Day for an Excursion

A variety of inspection trips was offered for the benefit of the interested visitor including a number on Saturday morning. Most of these exhibited the construction activities of the city in the fields of transportation, water supply, and sanitation. The most ambitious one was that arranged for the full day on Friday. Buses left at intervals during the morning, the last ones just before noon, to accommodate those taking in the technical sessions. The earlier travelers visited the tremendous South Side Water Filtration Plant; but all joined for lunch at the Museum of Science and Industry in Jackson Park. All too little time was available at this interesting institution before departure was taken for the afternoon trip.

Traversing the lakeside city parks for miles on its way northward, the cavalcade first stopped in Evanston for a brief inspection of the large educational building almost completed for housing the Northwestern Technological Institute, a part of Northwestern University. Again northward, the route led through Fort Sheridan and almost to Waukegan, to the Great Lakes Naval Training Station. A special military review was then put on for the benefit of the visitors by part of the 8,000 cadets, after which there was an inspection of new barracks, roadways, and service buildings. The visitors agreed that the best demonstration of all was the final one—in the large mess hall where an excellent dinner was provided consisting of the regular evening mess of the sailors served in the regular naval manner.

Demonstration by Night

By the time the party trip had again reached Fort Sheridan on the return trip it was quite dark, with a light rain. This failed to dampen the ardor of the visitors who enjoyed for an hour a field demonstration of search lights, aircraft spotting apparatus, anti-aircraft artillery, and many other military exhibitions. The ride back to headquarters concluded a remarkably fine trip.

Almost a thousand members, students, and guests enjoyed the Chicago Meeting, including a large number of out-of-town ladies who were royally entertained by the local women with teas, trips, and visits. All the social events were on the same plane of excellence as the technical meetings. But attendance, even such large attendance, is only a partial measure of a successful meeting. The enjoyment of good comradeship and the exchange of up-to-the-minute ideas on technical advances is the priceless gain each visitor carried away from Chicago. It was a fine meeting in every sense.

Notable Additions to Honorary Membership

By action of the Board of Direction at its Chicago meeting on October 13, and by subsequent acceptance on the part of the members concerned, five new names have been added to the roll of honorary members of the Society, as follows:

Ralph Budd, M. Am. Soc. C.E.
William Kelly, M. Am. Soc. C.E.
Henry Earle Riggs, Past-President, Am. Soc. C.E.
John Lucian Savage, M. Am. Soc. C.E.
Henry Matson Waite, M. Am. Soc. C.E.

Already honored in their individual fields and services, these five men now receive one of the highest honors the profession can bestow.

Most of Mr. Budd's lifetime has been spent in railroad work. For years he was an associate and protégé of John F. Stevens, both in the United States and at Panama. He has been head of the Great Northern and the Burlington System. His wide familiarity with American and foreign railroading was recognized in his appointment as member of the Advisory Commission to the Council of National Defense, in charge of transportation. His important role in the development of diesel electric streamline trains, regarding which he has written for publications, is well known. He was a member of the Board of Direction from 1929 to 1931.

After graduation from the U.S. Military Academy at West Point, William Kelly served in the Corps of Engineers for almost 30 years. He served on both the east and west coasts, as well as in the Philippines. During the World War he rose to the position of Deputy Chief of Staff of the A.E.F. in France. Since his work as first chief engineer of the Federal Power Commission, he has devoted more and more time to the administration of power facilities. Resigning from the Army in 1928, he became an officer in the Buffalo Niagara and Eastern Power Corporation, of which he is now president. He received the James Laurie Prize of the Society for a paper on the Colorado River problem.

Nestor of the profession, Henry E. Riggs is widely known and beloved by all civil engineers. For the first 25 years of his professional career, he was in railroad work, most of the time as a consultant. Then followed an even greater service of almost 20 years as professor at the University of Michigan, from which he retired in 1930. Since then he has continued his consulting work, specializing in valuation and economics of railroads. In the service of the Society he has devoted unstinted time as Director, Vice-President, and President. Greatly beloved by all, Dr. Riggs will add luster to the status of honorary membership.

For one period of eight years in his professional career, John L. Savage was in consulting work, in association with A. J. Wiley in Idaho. Except for this interval his entire engineering career has been in the Bureau of Reclamation. Since 1924 he has been chief designing engineer, in charge of the office work on some of the most monumental projects ever conceived. In addition to his services for the Bureau, Mr. Savage has been consulted by the Tennessee Valley Authority and on work in Puerto Rico and at the Panama Canal. His many friends in the Bureau and throughout the country will be pleased to hear of this new honor that has come to him.

Also well and favorably known among engineers far and wide, is Colonel Waite, whose work has been in transportation, particularly among railroad companies. After a term as chief engineer of the City of Cincinnati, he became city manager of Dayton, Ohio, at a time when this form of government was experimental in nature. Then followed eminent service in the World War, after which, as a colonel, he returned to private practice. The splendid Cincinnati Union Terminal is one of his works. During the existence of the PWA he served as Deputy Administrator. Still later he was consultant to the Bureau of the Budget in Washington. Colonel Waite has shown great interest in the Society, for which he has worked not only as a vice-president in 1931 and 1932, but as a member of committees and as a representative of the organization.

It is expected that the ceremony of bestowing honorary membership on these five notable engineers will take place at the time of the Annual Meeting in January. In a later issue of Civil Engineering more extensive accounts of their accomplishments will appear.

Badges for Christmas Gifts

If the man of the family is a member of the Society and does not have a Society badge, your Christmas problem is solved. Badges for members who have never owned them can be had on order without complication. In the case of members who have lost their badges, a statement to that effect should accompany the order.

The badge for Honorary Members, Members, Associate Members, and Affiliates is blue enamel on solid 14-carat gold, the gold showing in the lettering and as a border around the shield. The price is $5, including the cost of engraving the member's name and grade of membership. The pin for Juniors is similar in shape and design, but is of 8-carat gold with a white border. It costs $2. The pin for Student Chapter members is gold filled and costs one dollar. Like the Junior pins it has a white border, but is maroon where the other pins are blue. The Junior and student pins are not engraved, but all pins have safety catches. Badges may be had in the form of fobs or charms for watch chains, if preferred.

The badges must be ordered by December 1 if delivery is desired before Christmas. All orders should be sent to Society Headquarters, 33 West 39th Street, New York, N.Y.

Society Membership Tops 17,000

ANOTHER milestone has now been reached by the Society—the membership role has passed the 17,000 mark. While nominally this figure was attained last May, it was not officially important because the list included a number of members in arrears of dues who would be dropped from the roles in September, by Board of Direction action, unless their status changed in the meantime. While a new peak of 17,187 was achieved on September 9, 1941, it was of short duration because of this unhappy procedure of dropping those in arrears of dues, which was carried out immediately thereafter. As a result, one week later, on September 16, the total was down to 16,963, although it did not remain there long. It was quickly swelled by the June graduates who are qualifying as Juniors in considerable numbers at this season of the year. As of October 9, the official roster of the Society totaled 17,012. This figure is a reliable indication of the Society's increasing membership trend, since it is not subject to seasonal deduction (the deduction for 1941 having already been made).

While statistics covering the period from January 1 to September 15 show that the number of additions in 1941 was about the same as in 1940, there has been a decided decrease in the losses sustained by resignations, deaths, and those dropped for non-payment of dues. For example, the loss this year to date due to inability to meet dues obligations was only 237 as compared to 382 in 1940. Another encouraging sign is the increase in reinstatements of former members. To date, the increase over 1940 is nearly 25%, indicating a sincere desire on the part of former members to again become actively affiliated with the Society.

A remarkable fact that should not escape unnoticed is the small number of members that had to be dropped for non-payment of dues in September 1941. During the depression years the Board of Direction was most lenient in canceling the dues of loyal members, who because of unemployment or other economic conditions found it impossible to meet this obligation. As a result the largest number dropped for non-payment between 1930 and 1933, inclusive, was 343 in 1932, with a low of 165 the following year. However, the number of members dropped for this cause jumped sharply to 618 in 1934, and to 724 in 1936. Thereafter it fell off somewhat, averaging about 450 each year for the next four years. The improvement in economic conditions that has taken place in this period has resulted in a rising membership curve, which directly reflects the desire of engineers to maintain Society membership.

In the year 1940 the role showed a net increase of 662, but for the current year to date the gain is over the 700 mark. From present indications it appears that the Society is likely to enjoy a constant increase in membership for the next few years at least.

CIVIL ENGINEERING Cuts to Be Destroyed

IN ACCORDANCE with its usual custom, the Society will destroy cuts from Volume 10 of CIVIL ENGINEERING—that is, 1940—at the end of the current year. Those wishing to have any of these illustrations should notify Society Headquarters before December 31, 1941. It should be noted that cuts for the covers and pages of special interest are available only as a loan.

The only charge will be the cost of forwarding by express or parcel post. Except for the fact that preference will be given to the authors of the articles in which the illustrations appear, requests will be filled in the order received.

Society Officers Nominated for 1942

THE Second Ballot to determine the official nominees to Society offices, other than President, for 1942, was canvassed on October 15, 1941. The official nominee for President was chosen by the Nominating Committee on October 13, in accordance with Article VII, Secton 4, of the Constitution. The complete list of nominees follows:

For President:

Ernest Bateman Black, of Kansas City, Mo.

For Vice-Presidents:

Zone I, Charles Milton Spofford, of Boston, Mass.
Zone IV, Thomas Elwood Stanton, of Sacramento, Calif.

For Directors:

District 1, Van Tuyl Boughton and George William Burpee, both of New York, N.Y.
District 4, Scott Barrett Lilly, of Swarthmore, Pa.
District 11, A. M. Rawn, of Los Angeles, Calif.
District 14, William Dewoody Dickinson, of Little Rock, Ark.
District 15, John Thomas Lamar McNew, of College Station, Tex.

These nominees will be voted on by the use of the final ballots sent to every corporate member at least 40 days before the Annual Meeting in January. One week before the meeting the ballots will be canvassed, and the elected officers will be inducted into office at the Meeting. The official report of the tellers follows:

REPORT OF TELLERS ON SECOND BALLOT FOR OFFICIAL NOMINEES

October 15, 1941

To the Secretary
American Society of Civil Engineers

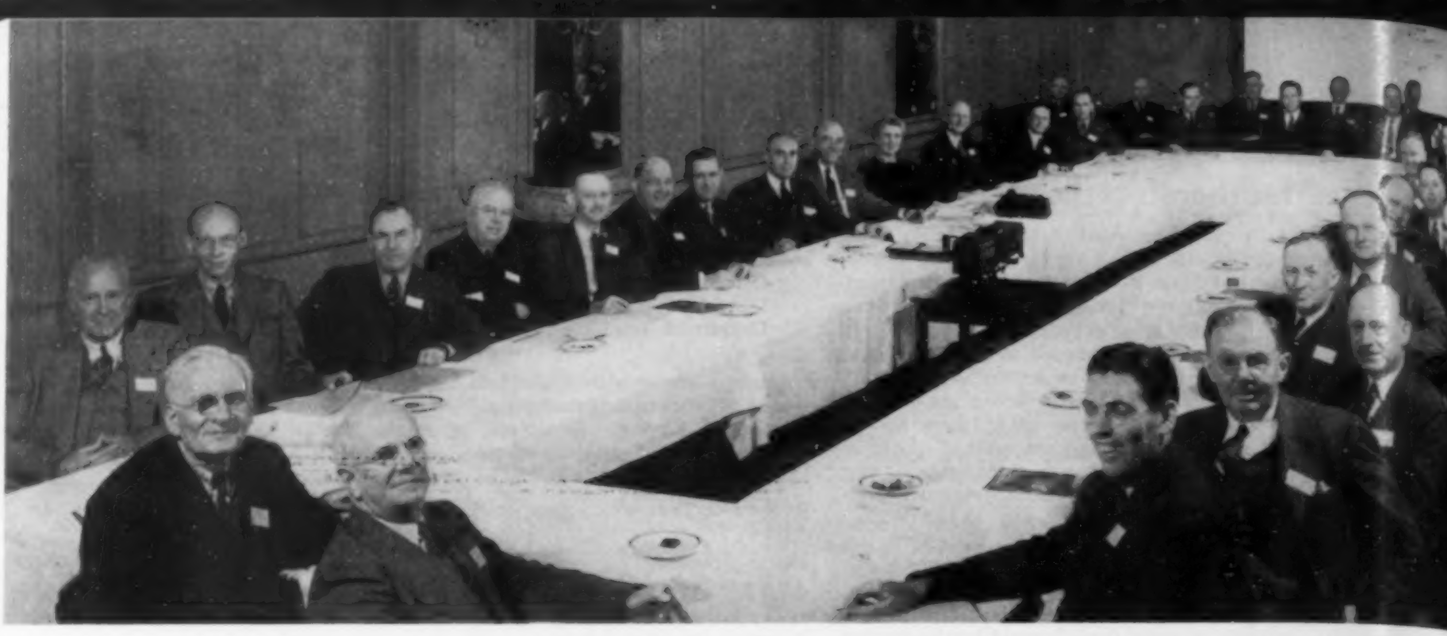
The tellers appointed to canvass the Second Ballot for Official Nominees report as follows:

For Vice-President, Zone I		
Gordon Maskew Fair	300	
Arthur William Harrington	487	
Charles Milton Spofford	501	
Void	14	
Total	1,302	
For Vice-President, Zone IV		
Frederick Charles Herrmann	460	
Armando Santacruz, Jr.	279	
Thomas Elwood Stanton	505	
Void	5	
Total	1,249	
For Director, District 1 (*Two to be elected*)		
Van Tuyl Boughton	672	
George William Burpee	670	
Void	0	
Total	1,342	
Actual number of ballots received	672	
For Director, District 4		
Howard Thompson Critchlow	168	
Scott Barrett Lilly	177	
Void	2	
Total	347	
For Director, District 11		
A. M. Rawn	345	
Void	0	
Total	345	
For Director, District 14		
Carl Wright Brown	81	
William Dewoody Dickinson	147	
Void	0	
Total	228	
For Director, District 15		
John Thomas Lamar McNew	320	
Void	1	
Total	321	
Ballots canvassed		3,126
Ballots withheld from canvass:		
From members in arrears of dues	59	
Without signatures	25	
With illegible signature	4	
Total withheld		88
Total number of ballots received		3,214

Respectfully submitted,

HARRY T. IMMERMAN, *Chairman*

F. L. Greenfield	Irvine P. Gould	Arthur S. Pearson
Benjamin Kriegel	R. B. Dillenbeck	Howard Holbrook
James McKeegan	Charles D. Thomas	T. R. Galloway
Abram Cortland	William H. Dieck	*Tellers*



Clockwise beginning at near corner of table: F. C. Woermann, President, St. Louis Section; C. F. Scott, Representative, Engineers' Council for Professional Development; F. F. McMinn, President, Cincinnati Section; C. V. Youngquist, President, Central Ohio Section; D. H. Barber, Director, Alabama Section; G. A. Maney, Chairman, Local Sections Conference Committee of Illinois Section; C. A. Wilson, Past-President, Wisconsin Section; A. M. Fromherz, Representative, Louisiana Section; H. G. Schlitt, Secretary, Nebraska Section; J. E. Jagger, Field Secretary, Am. Soc. C.E.; J. T. L. McNew, Chairman, Society Committee on Local Sections; Miss Edna Wilson, Stenographer; F. L. Castleman, Jr., Director, Nashville Section; C. J. Belz, Vice-President, Dayton Section; R. L. Whannel, Past-President, Central Illinois Section; S. M. Bailey, Representative, Kentucky Section; C. H. Guernsey, President, Oklahoma Section; O. C. Reedy, Member, Society Committee on Juniors, Denver, Colo.; C. A. Mockmore, Member, Society Committee on Juniors, Corvallis, Ore.; E. W. Bowden, Chairman, Society Committee on Juniors, New York, N.Y.; L. F. Bellinger, former Vice-President, Am. Soc. C.E., Atlanta, Ga.; F. V. Ragsdale, President, Mid-South Section, and Member, Society Committee on Juniors; H. P. Warren, President, Tri-City Section; L. G. Straub, Past-President, Northwestern Section; L. D. Knapp, Secretary, Wisconsin Section (next to table); E. S. Loane, Secretary, Maryland Section (extreme right); J. A. Focht, Secretary, Texas Section; R. P. Hoelscher, President, Central Illinois Section (next to table); L. O. Stewart, Secretary, Iowa Section (between Focht and Loane); G. B. Earnest, Secretary, Cleveland Section; H. H. Hale, Member, Society Committee on Local Sections, and President, Georgia Section (pipe in mouth); Erwin Harsch, President, Tennessee Valley Section; G. W. Lamb, Secretary, Kansas Section; W. M. Spann, Member, Society Committee on Local Sections, and Representative, Kansas City Section; H. W. Wood, Jr., Vice-President, Mid-Missouri Section; E. L. Eriksen, President, Michigan Section; R. A. Nyquist, President, Toledo Section.

Representatives at Chicago Local Sections Conference

October 14, 1941

Representatives of twenty-five more Local Sections of the Society met in an all-day conference in Chicago to exchange views on problems of broad professional interest and on specific problems concerning the internal administration of Sections. The conference was held in the Palmer House, Crystal Room, on Tuesday, October 14, prior to the opening of the Fall Meeting. Discussion was directed to the development of methods by which Sections can be of greatest assistance to the National Defense Construction Program; and how they may be of greatest benefit to the profession.

The conference was under the auspices of the Society's Committee on Local Sections, all the members of which were present for the conference. Three Local Section Conferences are held annually, one at the time of the Spring Meeting, another at the Annual Convention, and the third at the Fall Meeting. This arrangement provides each Section with an opportunity to be represented at a conference and to carry back to the Section they represent ideas and plans obtained from representatives of the other Sections present.

Daniel W. Mead Prizes—1941 Awards and 1942 Subjects

Announcement of the winners of the 1941 competitions for Daniel W. Mead Prizes was made on the occasion of the Student Chapter Conference in connection with the Society's Fall Meeting in Chicago, on October 15. The Junior Award, consisting of $50 in cash and a certificate, went to Don P. Reynolds, Jun. Am. Soc. C.E., for his paper, "Ethics of Junior Construction Engineers." Mr. Reynolds obtained a B.S. degree from the University of Michigan in 1938 and more recently has been a structural engineer with the Sun Oil Company in Toledo. At the same time announcement was made of a similar student award, consisting of $25 in cash and a certificate. This was made to Edward Wesp, a senior at New York University, and a member of the Student Chapter there. His subject was "Ethics of the Engineer Inspector."

These Mead Prizes, endowed by and named after Daniel W. Mead, Past-President and Honorary Member of the Society, are given for papers in the field of ethics. The competition—one prize open to Juniors, the other to students—has been carried on successfully for two consecutive years. The Society's Committee on Professional Conduct has been designated to conduct the competition and to determine the awards, assisted by the four Vice-Presidents of the Society, each of whom conducts an elimination procedure within his Zone. The selection of the topics for each year is made by the Committee on Professional Conduct.

In 1940, the Junior award was made to Allen Jones, Jun. Am. Soc. C.E., for his paper on "Ethics of Sales Engineering." The Student award was made to Harry Balmer, now president of the George Washington University Student Chapter, Washington, D.C., for his paper on "Ethics of Engineering Students." The rules for the competition are available upon request to the Secretary of the Society, and are contained in the current Year Book of the Society, page 120.

It is hoped that the actual bestowing of the current awards on Mr. Reynolds and Mr. Wesp may be arranged for the Annual Meeting of the Society in January 1942. These and other honors and prizes are a notable part of the program at that time.

Also announced at the Chicago Meeting were the topics for papers in the 1942 competition, as follows:

For students, "Ethical Standards and How Best They Can Be Developed."

For Juniors, "Observations of Ethical and Unethical Practice by Older Engineers."

While the prize awards made available by Dr. Mead are generous, there is a still more important though intangible value to be derived by recipients of these prizes. These awards add to the professional stature of those who win them and their names are permanently listed in the records of the Society.

Each Junior and Student Chapter member should seriously consider entering these competitions for 1942, topics for which were announced in the September issue of Civil Engineering.

Student Prizes Awarded

At the end of each school year many of the Society's Local Sections present awards to engineering students graduating with high scholastic honors from schools and universities within their territories. The awards vary, consisting usually of payment of the recipient's initiation fee as a Junior in the Society and, in some cases, of his dues for one year. In all cases, of course, the awards are contingent on the favorable action of the Board of Direction upon the recipient's application for membership. Word of the following prize winners for 1941 has reached Society Headquarters:

Name of Student	College	Local Section Giving Award
Donald P. Armstrong	University of Arizona	Arizona
Robert A. Chase Mark L. Knight Bernard L. Miller	University of Illinois	Central Illinois
Donald W. Apple William H. Lersch	Ohio State University	Central Ohio
John A. Diehl Charles R. Nuckolls	University of Cincinnati	Cincinnati
Robert J. Lyman	Ohio Northern University	Cleveland
John L. McNeill	University of Colorado	Colorado
Arigo Martini	Catholic University of America	District of Columbia
Harry O. Wright, Jr.	George Washington University	
Charles M. Brakefield, Jr.	University of Florida	Florida
Bernard M. Schmitter Harold C. Van Arsdale	Georgia School of Technology	Georgia
Harold J. Andrews	Northwestern University	Illinois
John L. Donoghue	Illinois Institute of Technology	
Jack K. Hamm	University of Illinois	
Raymond C. Hogan	Rose Polytechnic Institute	
Lewis B. McCammon, Jr.	Purdue University	
Albert D. M. Lewis Clarence H. Myers	Purdue University	Indiana
Donald C. Davis	State University of Iowa	Iowa
John B. Wentz	Iowa State College	
William N. Freeman	Cornell University	Ithaca
William C. Alsmeyer	Missouri School of Mines	Kansas City
Garland B. Childers	Kansas State College	Kansas
Leonard I. Schroeter	University of Kansas	
Louis F. Birkel, Jr.	University of Louisville	Kentucky
Woodford L. Robards	University of Kentucky	
Stephen T. Lowry	Lehigh University	Lehigh Valley
Glen U. Rothermel	Bucknell University	
William N. Taggart	Lafayette College	
Carl A. Carlson	California Institute of Technology	Los Angeles
George J. Bauer Fredrick R. Knoop, Jr.	Johns Hopkins University	Maryland
Lawrence J. Hodgins, Jr.	University of Maryland	
George Packer	College of the City of New York	Metropolitan
Sidney Weniger	Cooper Union	
John E. Kinney	Manhattan College	
Eugene V. Dotter	Newark College of Engineering	
Milton M. Feldman	New York University	
Albert B. Milashefsky	Brooklyn Polytechnic Institute	
Anthony J. Del Mastro	Rutgers University	
Howard L. Furr	Mississippi State College	Mid-South
James A. York	University of Nebraska	Nebraska
Fremont W. Slattery, Jr.	University of New Nexico	New Mexico
Otis W. Boise	New Mexico State College	
Chester D. Okerlund (1st prize) Robert A. Nielsen (2d prize) George K. Myrhaugen (3d prize)	University of Minnesota	Northwestern
George L. Jacobson	North Dakota Agricultural College	
Louis A. Gerdin	University of North Dakota	
Donald H. Jackson	South Dakota State College	
William Schmitt	South Dakota School of Mines	
Nathaniel Ford	University of Oklahoma	Oklahoma
Alfred C. Winters	Oklahoma Agricultural and Mechanical College	
Dick W. Ebeling Robert Stockman	Oregon State College	Oregon
John E. Krome	Princeton University	Philadelphia
William L. Weller	Drexel Institute	
Chester A. Beemer	University of Pittsburgh	Pittsburgh
William R. B. Froelich	Carnegie Institute of Technology	
Morrison G. Cain, Jr.	Clarkson College	Rochester (N.Y.)
Arthur Kaufman	University of Nevada	Sacramento
Robert G. Dyktor	Washington University	St. Louis
William G. Purdy	University of Missouri	
Carl A. Olson, Jr.	University of California	San Francisco
Kenneth J. Friedenbach	University of Santa Clara	
Steven J. Viscovich	Stanford University	
Norman Dahl	University of Washington	Seattle
Edward H. Lesesner	Clemson College	South Carolina
Fred R. Cheatham	Washington State College	Spokane
Francis H. Shadel	University of Idaho	
Jack D. London William B. Winn	University of Tennessee	Tennessee Valley
Neil P. Richards	University of Utah	Utah
Frank G. Louthan, Jr.	Virginia Military Institute	Virginia
Abbot A. Sackheim	Virginia Polytechnic Institute	
Nils D. Kjellstrom	University of Virginia	
Douglas W. Phillips	West Virginia University	West Virginia
Howard B. Saunders James H. Zoller	University of Wyoming	Wyoming

Other awards of Junior membership in the Society made at commencement time included the Dam Club Prize to Philip Sperber, of the College of the City of New York; the Kruesi Prize to Alfred Mouron, of the University of Tennessee; and the Milo S. Ketchum Award, made by the civil engineering department at the University of Colorado, to Oscar B. Jacobson, of the University of Colorado.

In a competition for cash prizes, conducted by the Nashville Section, first prize of $12 went to Alfred Grief; second prize of $8 to Ralph Carter; and third prize of $5 to Miles Algood.

Preparedness for Post-War Conditions

Initial Report of Committee Adopted by Board of Direction at Its Meeting in Chicago

It is not possible to know when the present war will end or what conditions will then exist. A satisfactory outcome from the standpoint of the United States must be accomplished, but it is very clear that post-war conditions may be quite unlike any conditions we may choose to call normal, and will call forth all the ingenuity and resourcefulness of our leaders in meeting them adequately. The American Society of Civil Engineers must do all in its power to contribute to the satisfactory solution of post-war problems, whatever they may be.

More than ever before, it is now clear that the greatest strength of a nation lies in its natural resources, its applied man power, and the principle of work. A busy nation, whether through necessity or choice, is a strong nation. A nation with people unoccupied is in a dangerous and unhealthy situation. The people of this nation, in the post-war period, must be kept busy and at work at worth-while things.

As demonstrated so clearly in the past ten years, a sound program of necessary public construction of permanent worth is invaluable in maintaining a healthy nation in times of stress and disturbed economic conditions. When industrial employment slows down, employment on necessary public construction is doubly important and valuable.

During the past year, because of increasing defense activities and the resulting shortage of man-power and materials, the usual construction activities have rapidly dried up. This will continue increasingly until the war is ended. State highway, county, and city departments are finding their normal construction programs greatly curtailed or stopped almost entirely. Railroads and other large semi-public and private organizations are in the same or a worse predicament. Clearly there will be a pent-up flood of worth-while construction activities which may be loosed with the ending of the war, and now is the time to think of how this activity may be arranged and organized so that it may proceed rapidly when needed, and in accord with plans previously prepared. Work done without plans is most wasteful. Proper plans require time. Time should not be taken for plans at the expense of time which should be used for work. The answer lies in proper advance planning.

The American Society of Civil Engineers affirms the following Statement of Principles:

1. A program of post-war worth-while construction is strongly endorsed.
2. Advance planning is most essential, and requires time.
3. The revival of the Federal Public Works Administration or the establishment of a department of the Reconstruction Finance

Corporation, and the continuance of the Public Roads Administration, to administer a program of post-war construction is strongly recommended because of the satisfactory showing made by the PWA and the other agencies mentioned, in administering worthwhile construction projects of permanent value.

4. A comprehensive list of construction projects throughout the nation should be developed for analysis and use as conditions warrant, all of which should be judged carefully as to immediate need, future worth, and economic soundness.

5. The selection of projects for actual planning and construction should meet the rigid examination and approval of a strong and competent Technical Federal Board of Review, representing the PWA or the RFC and the Public Roads Administration.

6. The actual planning and work on these projects should be executed only by the local agencies responsible for same, namely, the state, county, or city in which the project is located.

7. There should be a Federal appropriation of funds at the proper time to permit the development of adequate plans and specifications for those projects meeting the approval of the Technical Federal Board of Review.

8. Plans for approved projects must be prepared by qualified, competent, and experienced engineers selected by the local agency which is to execute the work, such as the engineers of state, county, and city departments and those in private practice.

9. The construction of all approved projects must be carried out by competent and experienced contracting organizations, following the accepted principles of competitive bidding, established costs, and definite placement of responsibilities.

10. Effective planning requires thinking in advance of the emergency, not after the crisis is reached.

Vox Populi

THE "voice" of the civil engineer, given expression as discussion in PROCEEDINGS, determines the degree of service which that organ can render to the profession. Any number of technical papers can be published; but without the testing fire of critical discussion, the profession has accomplished little more than would a fairly large bulletin board—passive in its offering of information.

It is because PROCEEDINGS "talks back" in critical or analytical comment, that it has maintained a vital place in the lives of civil engineers all over the earth. This has been true for nearly three-quarters of a century.

A normal expectancy is one page of discussion for each page of the original paper. The tempo has a seasonal swing, with the low point ordinarily occurring in the autumn months. By contrast, therefore, the experience of the past few months gains additional significance. An avalanche of discussion has been received and published in the September and October numbers—180 pages on 26 papers in the September PROCEEDINGS, and 164 pages on 23 papers in the October PROCEEDINGS. The inevitable effect was to leave room for only one new paper in each of these issues.

On the basis of past experience, it seems likely that this active rate will diminish somewhat in the remaining months leading up to the Christmas holidays; but the evidence is clear that many readers are grasping anew the meaning of their obligations to their Society and the profession. Open discussion is a privilege—and it is a sign of a healthy professional consciousness.

Prize Awards for 1940

ON RECOMMENDATION of the Committee on Prizes, the Board of Direction, at its meeting on October 13, announced the selection of the following as winners of prizes for papers appearing in Vol. 105 (1940) of TRANSACTIONS.

J. A. VAN DEN BROEK, M. Am. Soc. C.E., the Norman Medal for his paper, "Theory of Limit Design."

EARL I. BROWN, M. Am. Soc. C.E., the J. James R. Croes Medal for his paper, "Beach Erosion Studies."

O. J. TODD, M. Am. Soc. C.E., and S. ELIASSEN, Assoc. M. Am. Soc. C.E., the Thomas Fitch Rowland Prize for their paper, "The Yellow River Problem."

SAMUEL A. GREELEY, M. Am. Soc. C.E., the James Laurie Prize for his paper, "Sewage Disposal Project of Buffalo, New York."

ELMER ROCK, Jun. Am. Soc. C.E., the Collingwood Prize for Juniors for his paper, "Design of a High-Head Siphon Spillway."

FRED LAVIS, M. Am. Soc. C.E., the Arthur M. Wellington Prize for his paper, "Transportation Developments in the United States."

THOMAS R. CAMP, M. Am. Soc. C.E., the Karl Emil Hilgard Hydraulic Prize for his paper, "Lateral Spillway Channels."

The ceremony of bestowing these prizes will be held at the time of the 1942 Annual Meeting in January. A more complete account of the accomplishments of these prize winners will appear in a later issue of CIVIL ENGINEERING.

New Members of Division Executive Committees

AS PROVIDED in the Society's By-Laws, one new member is added each year to the executive committee of every Technical Division In making these appointments, the Board acts on suggestions made by the nominating committees of the various Divisions. Following this procedure, nominations were received by the Board at its Chicago meeting on October 13, and new members were appointed. They take office at the expiration of the present term, in January 1942. By Board approval the following will serve for five-year terms:

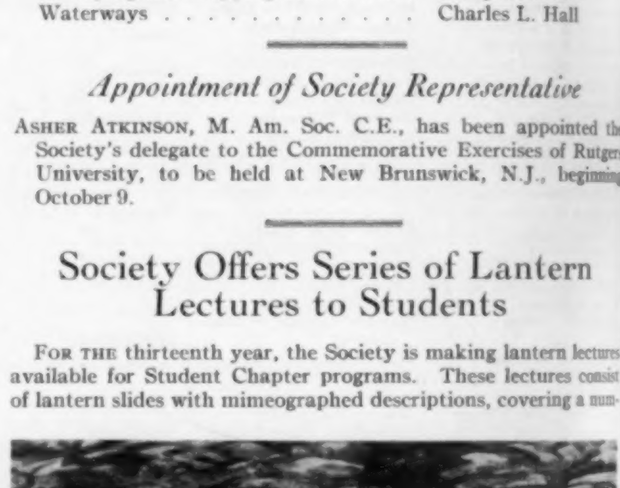
TECHNICAL DIVISION	NEW EXECUTIVE COMMITTEE MEMBER
City Planning	William J. Shea
Construction	Adolph J. Ackerman
Engineering Economics	E. M. Hastings
Highway	Day I. Okes
Hydraulics	Boris A. Bakhmeteff
Irrigation	H. D. Comstock
Power	H. J. Flagg
Sanitary Engineering	G. J. Schroepfer
Soil Mechanics and Foundations	Charles H. Lee
Structural	Alfred Hedefine
Surveying and Mapping	Philip Kissam
Waterways	Charles L. Hall

Appointment of Society Representative

ASHER ATKINSON, M. Am. Soc. C.E., has been appointed the Society's delegate to the Commemorative Exercises of Rutgers University, to be held at New Brunswick, N.J., beginning October 9.

Society Offers Series of Lantern Lectures to Students

FOR THE thirteenth year, the Society is making lantern lectures available for Student Chapter programs. These lectures consist of lantern slides with mimeographed descriptions, covering a num-



MAPPING PLANE "EXPLORER" IN FLIGHT—FROM LANTERN LECTURE ON AERIAL PHOTOGRAPHIC MAPPING

ber of important engineering projects. They are sent to any Student Chapter (or Local Section or other interested group) without charge.

The variety of subjects included in the series is shown in the following list, which gives the title of each lecture and the number of slides it contains:

Lectures	No. of Slides	Lectures	No. of Slides
Aerial Photographic Mapping	60	Grand Coulee Dam	60
Bonneville Dam	61	Hetch Hetchy Water Supply	65
Boulder Dam	75	Holland Tunnel	58
Carquinez Strait Bridge	58	Miami Flood Control	53
Cascade Tunnel	45	Mississippi Flood Control	64
Catskill Water Supply	67	Norris Dam	69
Conowingo Hydro-Electric Development	46	Power Development at Niagara Falls	34
Coolidge Dam	57	San Francisco–Oakland Bay Bridge	70
Florianopolis Bridge	36	Westchester County Park System	40
Foundation Problems of West Side Elevated Highway—New York	57	Wheeler Dam	54
George Washington Bridge	74	Wilson Dam at Muscle Shoals	47
Golden Gate Bridge	52		

In addition to the above lantern lectures, the Society has a 16-mm moving picture film in color showing scenes of the Tacoma Bridge during its failure on November 7, 1940.

Marshall Cutoff—from Lantern Lecture on Mississippi Flood Control

Reservations for this film and all lectures should be made well in advance of the date when they are to be shown. Experience has proved that those who wait until the last minute have often been unable to obtain the particular lecture desired.

Service to the Profession Is Recognized

It may seem at times that the Society's service to the engineering profession brings very little recognition. However, the idea is controverted by a case which recently arose. An interesting letter was received at Headquarters from an engineer in the West. A few excerpts from this letter, addressed to the Secretary of the Society, will serve to show that a disinterested service sometimes has its reward.

"On several occasions I have written to you for general engineering information. Your answers were, in every instance, outstanding as compared with others received on the same subject.

"This created in my mind the desire to belong to a group of men guided by high principles. Please send me some general information on how to become an Associate Member of your esteemed organization."

This is just one example of the impression created unconsciously in the minds of engineers throughout the country by the Society's general activities for the benefit of the profession as a whole.

Recognition of Student Chapter Accomplishments, 1940–1941

Yearly since 1935, the Committee on Student Chapters has recommended, for the approval of the Society's Board of Direction, twelve Student Chapters to receive the President's letter of commendation for their record of activities and accomplishments during the preceding school year. The Board of Direction, at its meeting in Chicago, confirmed the Committee's recommendations for the year 1940–1941. As a result the President's letter of commendation is being sent to the following Chapters:

Location of Chapter	Date Established	Number of Times Commended
Northeastern University	1940	1st time
Southern Methodist University	1940	1st time
Brooklyn Polytechnic Institute	1921	2nd time
University of California	1921	2nd time
University of Dayton	1926	3rd time
Pennsylvania State College	1920	3rd time
Stanford University	1920	4th time
Johns Hopkins University	1921	4th time
New York University	1921	4th time
University of Illinois	1921	6th time
Virginia Military Institute	1921	6th time
Tulane University	1933	7th time

Suggestions for Next Year's Student Chapter Secretary

Timely Excerpts from the 1940–1941 Report of the University of California Student Chapter, Which Received One of the President's Letters of Commendation

In order that the secretary be advised of the duties to be expected of him, he should avail himself of the Annual Report of the previous year. A few suggestions as to the taking of minutes at each meeting may be in order at this time. Each report should be a summary, short and concise, but containing the necessary facts. I believe it is unnecessary to write minutes while a meeting is going on except to record important business such as nominations and so on. Naturally it is necessary to construct the write-up of the meeting before the important details have slipped one's memory. This method of recording minutes will lead to the desired result—short, concise, and meaty material.

A job that is of great importance to the Student Chapter is that of the photographer. It takes good pictures to turn out a good report. It seems to have fallen to the secretary to arrange to have pictures taken of guest speakers, nominees, and so on. It is of utmost importance that these pictures be available, for they are vital to the Annual Report. Do not leave the job of obtaining pictures for the fall semester to the secretary for the spring semester.

With a view toward the next year's report, the secretary should take it upon himself to collect all newspaper clippings from the *Daily Californian* and the *Berkeley Gazette* which tell of the Student Chapter's activities. The job of submitting items to these newspapers should naturally fall to the chairman of the publicity committee, but it has been found that the secretary must push the job or take it upon himself. A small, but nevertheless important, part of the report is that showing participation of the Student Chapter members in outside activities. It also falls upon the secretary to make a collection of these clippings from the various newspapers.

If the secretary will remember that he is working toward the construction of a successful annual report, he will have no trouble in carrying out his duties well.

Socialization of the Engineering Profession

Considered by the Board of Direction at Its Chicago Meeting

THE BOARD of Direction, at its regular meeting, held October 13 and 14, 1941, at Chicago, devoted much thought to evidence, brought to its attention from various sources, of the accelerating trend towards the absorption, by the Federal Government, of engineers as salaried employees. Its appraisal of this situation is expressed as follows:

1. The Board of Direction of the American Society of Civil Engineers believes the best training for engineers and the best engineering services are obtained through the experience gained in private practice and in many of the regularly established engineering departments of cities, states, railroads, and utilities. Engineers so placed have served this country well for over a hundred years and great numbers of them are available to design and supervise the building of the structures necessary for the growing requirements of the country.

2. This is not to say that there are not Federal agencies which have given good service in specialized engineering fields and have trained and developed many able engineers. Within the longer established departments of the Federal Government there are now many engineers, each highly skilled in his own specialty; but the extension of the work of these departments into fields of engineering new to them, with consequent sudden enlargement of staff and delegation of skilled supervision, cannot but lead to inferior performance.

3. During the recent depression the Federal Government called upon engineers experienced in private practice, as well as those in city and state departments and in the utilities, to assume charge of administration, design, and supervision of construction of public works costing many billions of dollars. Upon the initiation of the present war effort, these same engineers were called upon again. Upon both occasions they rendered valuable assistance to the Government.

4. The present need for engineers is indeed great. They are now engaged in designing and building great war plants with attendant utilities. Soon engineers will be called upon to assist in operating such plants. Already, also, thought is being given to the conditions likely to prevail at the close of the present national emergency, and vast public works have been proposed to relieve depression and want at that time. Again the need for engineers will be great.

5. It is the opinion of this Board of Direction that the rapid expansion of engineering staffs by agencies of the Federal Government in times of stress, by depleting the staffs of existing engineering organizations, will not produce sound engineering expeditiously or at low cost.

6. The Board has been reliably informed that a movement is afoot to build up engineering forces within Federal Governmental agencies to perform hereafter, with salaried staffs, the engineering work previously done by engineers in private practice. This movement, it is believed, is inimical to the best interests of the engineering profession and is not conducive to the most efficient utilization of the engineering talent of the country.

7. Because of the reported tendency to thus socialize the engineering profession, which it is believed will result in great harm to, or the destruction of, the long established and successful method of utilizing engineers, and because the American Society of Civil Engineers can be considered as truly representative of that branch of engineering most intimately concerned with this changing attitude, the Board has formulated the following principles:

(a) The country will be best served by the use of engineers in private practice, in state and city departments, and in the utilities; it will not be best served by the assemblage of these engineers into Federal service on a salary basis.

(b) The engineering profession and engineering talent will suffer if engineers who now are, or until recently were, in private practice are to have their normal opportunities absorbed by the Federal Government.

(c) Engineers, whatever the form of remuneration, are entitled to adequate compensation for their services.

The Board, therefore, has appointed a committee to further the acceptance of these principles and has engaged an engineer to be resident in Washington to assist the committee.

News of Local Sections

Scheduled Meetings

ARIZONA SECTION—Annual meeting at the Westward Ho Hotel on November 22, at 9:30 a.m.

CONNECTICUT SECTION—Dinner meeting at the Graduates' Club on October 30, at 6:30 p.m.

FLORIDA SECTION—Luncheon meeting at the George Washington Hotel in Jacksonville on November 8, at 12:30 p.m.

ILLINOIS SECTION—Dinner meetings of the Junior Section at the Central Y.M.C.A. on November 4 and 17, at 6 p.m. (Program 7 p.m.)

IOWA SECTION—Meeting in Des Moines about November 19.

METROPOLITAN SECTION—Technical meeting in the Engineering Societies Building, New York, on November 19 at 8 p.m.; regular lecture meetings of the Junior Branch in the Engineering Societies Building on November 12 and 26, at 7:30 p.m.

MIAMI SECTION—Dinner meeting at the Alcazar Hotel on November 6, at 7 p.m.

MICHIGAN SECTION—Meeting in Ann Arbor on November 17.

MID-SOUTH SECTION—Annual meeting in the Vicksburg Hotel, Vicksburg, October 31–November 1.

NORTHWESTERN SECTION—Joint dinner with the Junior Chapter at the Coffman Memorial Union, University of Minnesota, on November 3, at 6:30 p.m.

PHILADELPHIA SECTION—Dinner meeting at the Engineers' Club on November 11, at 6 p.m.

PITTSBURGH SECTION—Talk at the William Penn Hotel on November 13, at 8 p.m. (Date subject to change.)

SACRAMENTO SECTION—Regular luncheon meetings at the Elks Club every Tuesday at 12:15 p.m.

SEATTLE SECTION—Dinner meeting at the Engineers' Club on November 24, at 6 p.m.

TACOMA SECTION—Dinner meeting at the Lakewood Community Center on November 11, at 6:30 p.m.

TENNESSEE VALLEY SECTION—Annual meeting at Knoxville on November 14 and at Cherokee Dam on November 15.

TEXAS SECTION—Luncheon meeting of the Dallas Branch at the Dallas Athletic Club on November 3, at 12:10 p.m.

TRI-CITY SECTION—Dinner meeting at the Mississippi Hotel, Davenport, Iowa, on November 14, at 6:30 p.m.

VIRGINIA SECTION—Afternoon and dinner meeting at the Roanoke Hotel on November 7, at 2:30 p.m.; an inspection trip to the Radford Powder Plant on November 8.

Recent Activities

COLORADO SECTION

The speaker at the regular dinner meeting, which took place on September 8, was Fred C. Scobey, principal irrigation engineer for the U.S. Department of Agriculture. Mr. Scobey discussed "The Hydraulic Jump and Its Variations," illustrating his talk with colored slides showing various instances in which the hydraulic jump is used for the dissipation of energy or for the purpose of regaining hydraulic head.

HAWAII SECTION

The Hawaii Section announces the formation of a Junior Forum. The initial meeting was held on September 7, at which time organization plans were completed. The Forum will be conducted by a rotating committee of three—one new member to be elected at each meeting and each to serve for a total of three meetings, the senior member to be chairman. The secretary will be R. B. Lovejoy,

while the initial committee consists of Messrs. Anderson, Parlett, and Yates.

Los Angeles Section

A talk on "Naval and Marine Corps Pilot Training Under the National Defense Plan" was the feature of the meeting held on September 10. This was given by Maj. William J. Fox, chief engineer of the Los Angeles County Department of Building and Safety, who discussed the morale of the trainees, the problems encountered in training pilots, and the defects in our present military planes from the standpoint of operation and the demands they place on the pilots. His talk was followed by a motion picture showing the training of navy pilots at Pensacola and San Diego. Then Richard M. Merriman discussed the Pennsylvania Turnpike, on the construction of which he was chief tunnel engineer. His talk was illustrated with a motion picture of construction methods used on the project.

Maryland Section

The September 22d meeting of the Maryland Section was preceded by a dinner, held jointly with the Engineers Club of Baltimore, in honor of A. C. Clarke, newly elected chief engineer of the Baltimore and Ohio Railroad. Following dinner the out-of-town and other guests were introduced to the members. Mr. Clarke acknowledged his introduction with a brief talk on the subject of air-raid shelters for Baltimore. The meeting proper then got under way. F. A. Allner, as chairman of the Section's Committee on Civilian Protection in War Time, opened the symposium on civilian protection with a talk which covered the organization of the state and district Councils for Defense and of the Society's Committee on Civilian Protection. Air-raid shelters and the protective value of buildings were then discussed by H. F. Doeleman, while Frank Roberts spoke briefly on the activities of the Maryland Council for Defense in speeding production of defense materials and in preparing for civilian protection. John D. Elder reported his observations made during frequent trips to Germany during the thirties, and Dr. Huntington Williams gave an off-the-record talk on present-day England. Dr. Williams, who is health commissioner of Baltimore, recently visited England in the company of other experts and made a study for the government of various aspects of civilian protection. A lively question-and-answer period concluded the meeting.

North Carolina Section

On September 4 members of the North Carolina Section met in Charlotte for dinner and to hear J. N. Pease, Charlotte consultant, speak on "Engineering on Defense Projects." Mr. Pease, who was engineer in charge of all the recent construction work at Fort Bragg, discussed some of the problems involved in expanding the post from a capacity of 9,000 troops to its present capacity of 44,000 troops, with provision for a probable increase to 65,000. The contract for both engineering and construction was let on the same day with orders that plans must be filed in Washington and work started within ten days. It was also ordered that all housing and facilities for 16,000 men must be ready for occupancy in three months and the entire cantonment completed in eleven months. With the exception of a good topographical map, made by the Corps of Engineers, the work started at scratch. The work extended over an area of five by seven miles, thus indicating the extent of the utilities required. Mr. Pease stated that the most pressing immediate demand was for water to begin construction work and roads and trackage to deliver materials. Two tanks of 80,000 gal each and one of 1,000,000-gal capacity were needed. Since it was impossible to get a bid on the latter for delivery within nine months, it was built of reinforced concrete. Three concentric walls 8 in. thick and 80 ft high were run up during a continuous operation of seven days, the forms being continually jacked up. On these was placed a floor of reinforced concrete, and the tank built on that. Sufficient trackage had to be provided to unload 200 cars of materials per day, and 75 miles of highway were built.

Northwestern Section

Several members of other Sections were present at the October 6 meeting of the Northwestern Section. Following dinner and the introduction of these guests, J. Arthur Jensen, superintendent of the Minneapolis Water Works, discussed the history and construction of the Minneapolis water system and the new water-softening plant. Mr. Jensen then introduced Edgar Johnson, assistant engineer of the Minneapolis Water Department, who described some of the difficulties involved in furnishing satisfactory water.

Pittsburgh Section

On September 23d the members of the Pittsburgh Section met jointly with the civil engineering section of the Engineers Society of Western Pennsylvania to hear Lieut. Col. Lewis A. Pick, Corps of Engineers, U.S. Army, speak on "The Place of the Engineer in National Defense." On the following day there was a good fellowship dinner, followed by a talk by Frank Roessing, Director of Public Works for Pittsburgh. Mr. Roessing discussed his recent observations in war-torn England, after which several former presidents of the Section and George S. Davison, Past-President and Honorary Member of the Society, spoke briefly.

San Francisco Section

Plans for a series of seminars to prepare young engineers for the state examinations for civil engineering licenses were completed at the September 22d meeting of the Junior Forum. The technical program consisted of talks by H. C. Medbery, water purification engineer for the San Francisco Water Department, who spoke on the activities of the Purification Division of the Department; and R. A. Hattrup, engineer for the Standard Oil Company, who discussed his experiences on a survey of the Iraq-Saudi—Arabian Boundary. Both are members of the Forum. The topic for general discussion was "Should the Federal Government Force a Settlement in Defense Production Strikes?"

St. Louis Section

"The Effects of National Defense Activities on the St. Louis Defense Area" were discussed by C. H. Ellaby, president of the St. Louis Board of Public Service and chairman of the local committee on civilian defense. Mr. Ellaby described the increased employment and better business conditions resulting from the defense activities, but also showed that the development of large projects is causing critical sanitary conditions, severe housing and school shortages, and traffic problems.

Tri-City Section

The Tri-City Section began its fall activities with a smoker, which was held in Davenport, Iowa, on September 19. H. P. Warren, president of the Section, gave a short talk on the subject of "The Engineer and National Defense." An additional feature of the evening was the showing of two sound films—"Volcanoes in Ice" and "Geological Work of Ice." Refreshments and a general get-together concluded the meeting.

Wisconsin Section

At a meeting of the Section held on September 10 B. E. Brevik, structural engineer for the Portland Cement Association, showed a sound motion picture of the Pennsylvania Turnpike and one entitled "Limited Ways." Then Otto Rollman, consulting engineer of Green Bay, Wis., gave a talk on the Pennsylvania Turnpike. Mr. Rollman, who had served as one of the consultants on the project, described the construction problems and operation features involved and outlined the financial set-up.

Data Compiled from 1941 Annual Reports of Student Chapters

For the past two years, Civil Engineering has carried tables of statistical data about the 121 Student Chapters, abstracted from their Annual Reports for the previous academic years. It is believed that this information for the school year 1940–1941 will also be of interest to members of the Society, and the material accordingly appears on the following two pages.

The thanks and congratulations of all members are due the Faculty Advisers and Contact Members whose names appear after the Chapters they worked with during the past year. There is ample evidence from former years that the aid so generously extended by these men to the members of their respective Chapters not only has been instrumental in inducing many young engineers to join the Society but also has helped orient them in their early years in the profession.

Name of Chapter	No. of Members	Aver. Attend. at Mtgs. (Members Only)	No. of Meetings	Total No. of Visitors During Year	No. of Papers or Lectures: By Students	By Faculty	By Others	Am. Soc. C.E. Illus. Lectures	No. Meetings Attended by: Fac. Adviser	Cont. Mem.	Membership by Classes: Freshmen	Sophomores	Juniors	Seniors	Grad. Stud.	Evening Stud.	% of Eligibles Who Are Members	Members of Faculty: In Soc.	Not in Soc.	Faculty Adviser	Contact Member
Akron, Univ. of	16	11	7	4	1	0	0	0	1	1	0	0	7	8	0	1	100	2	1	R. C. Darst	E. D. Barstow
Alabama Poly. Inst.	37	18	16	133	6	3	12	4	14	10	3	4	17	12	1	0	26	4	1	T. M. Lowe	A. R. Harvey, Jr.
Alabama, Univ. of	22	10	13	90	4	1	6	0	7	4	0	3	6	13	0	0	54	4	3	D. du Plantier	A. C. Decker
Arizona, Univ. of	48	21	8	55	10	0	7	0	8	3	0	10	21	17	0	0	91	4	0	F. C. Keltan	J. H. Gardiner
Arkansas, Univ. of	25	23	15	22	30	1	1	0	14	2	0	0	13	12	0	0	90	2	2	W. R. Spencer	N. B. Garver
Brooklyn, Poly. Inst. of	80	27	15	105	0	3	8	0	9	3	0	10	20	10	0	40	60	18	3	E. J. Squire	Ben W. Dees† E. L. Macdonald
Brown Univ.	10	8	9	60	2	0	2	0	6	8	0	0	4	6	0	0	90	2	1	W. R. Benford	R. W. Albrecht† H. E. Miller
Bucknell Univ.	18	12	12	84	5	5	0	4	12	1	0	8	6	4	0	0	60	3	1	D. M. Griffith	J. T. Fetherston
California Inst. of Tech.	25	15	11	23	1	3	6	2	7	5	0	0	15	6	4	0	63	8	1	Franklin Thomas	H. Macy Jones
California, Univ. of	281	163	8	100	1	2	6	0	8	7	27	33	106	115	0	0	..	15	1	C. T. Wiskocil	W. W. Moore† Walter Dreyer
Carnegie Inst. of Tech.	49	43	30	..	16	2	12	2	30	0	0	15	17	17	0	0	100	7	0	F. McCullough	H. C. Crowle† J. F. Laboon
Case School of Applied Sci.	59	34	9	85	10	2	3	0	8	4	0	28	14	17	0	0	100	*6	0	G. E. Barnes	M. S. Brown
Catholic Univ. of Amer.	32	23	21	523	3	0	6	0	18	0	5	8	12	7	0	0	100	2	2	F. A. Biberstein	R. W. Berry
Cincinnati, Univ. of	102	18	10	3	0	2	3	0	5	4	20	16	27	37	2	0	100	4	1	R. W. Renn	F. W. Morrill
Citadel, The	63	30	9	2	4	0	2	0	6	1	0	12	34	17	0	0	73	2	4	John Anderson	J. E. Gibson
Clarkson Col. of Tech.	26	20	6	40	0	0	5	0	4	3	0	6	12	8	0	0	80	4	0	W. J. Farrisee	E. M. Fucik† W. T. Field
Colorado State Col.	33	..	13	17	2	1	6	0	13	9	2	3	10	18	0	0	..	2	2	N. Christensen	L. K. Hill
Colorado, Univ. of	72	37	21	350	23	0	10	0	19	1	0	15	21	36	0	0	82	7	1	C. L. Eckel	R. L. Parshall‡ R. N. Tracy
Columbia Univ.	15	..	21	400	12	7	3	0	19	0	0	1	5	8	0	0	..[b]	10	3	J. K. Finch	L. W. Crandall† E. P. Goodrich
Connecticut, Univ. of	20	14	8	12	1	1	3	0	6	2	0	8	7	5	0	0	..	3	0	C. O. Dohrenwend	S. A. Olin† H. W. Buck
Cooper Union	47	32	7	6	0	1	5	0	7	4	0	6	5	8	0	28	67	7	5	R. C. Brumfield	W. H. Yates
Cornell Univ.	58	20	8	172	4	0	6	0	7	2	5	14	17	19	3	0	27	16	10	F. A. Barnes	W. C. Stevens† H. E. Snyder
Dartmouth Col.	21	20	25	23	21	0	6	0	22	0	0	0	0	13	8	0	100	3	1	W. P. Kimball	
Dayton, Univ. of	17	17	14	96	12	2	6	2	14	3	0	6	4	7	0	0	100	3	2	C. J. Belz	C. H. Stephens
Delaware, Univ. of																					
Detroit, Univ. of	25	24	8	18	0	0	5	2	8	4	0	5	6	6	8	0	79	3	0	C. C. Johnston	M. J. Quinn
Drexel Inst. of Tech.	28	..	5	..	0	1	4	0	5	0	1	7	11	9	0	0	34	4	1	S. J. Leonard	H. J. Stetina
Duke Univ.	15	15	10	14	8	0	1	3	8	2	0	5	5	5	0	0	75	3	1	J. D. Watson	J. B. Letherbury† H. W. Kueffner
Florida, Univ. of	24	13	13	43	5	1	1	4	11	1	0	6	9	9	0	0	..[e]	4	0	W. L. Sawyer	D. S. Wallace
George Washington Univ.	18	18	9	229	3	0	5	0	8	1	2	8	2	6	0	0	20	2	0	C. H. Walther	W. J. Leseman† J. D. Fitch
Georgia School of Tech.	81	..	16	20	1	5	5	1	16	15	0	46	15	20	0	0	..	5	0	C. D. Gibson	P. A. Joray† L. W. Seawell
Harvard Univ.	69	37	8	780	0	1	7	0	6	2	0	1	3	6	59	0	..[f]	9	0	Albert Haertlein	H. M. Turner
Idaho, Univ. of	46	29	14	90	1	0	7	4	14	3	7	13	16	10	0	0	67	6	3	A. S. Janssen	W. P. Hughes
Illinois Inst. of Tech.	57	40	10	20	1	1	7	1	10	1	0	14	20	23	0	0	90	6	2	R. L. Stevens	A. J. Hammond
Illinois, Univ. of	224	62	15	230	1	3	7	1	10	5	42	34	62	85	1	0	75	37	0	J. J. Doland	W. D. Gerber
Iowa State Col.	97	82	12	238	1	6	5	1	10	9	2	28	43	24	0	0	66	29	1	Frank Kerekes	M. B. Morris
Iowa, State Univ. of	32	28	25	11	25	5	3	4	25	2	0	0	15	17	0	0	100	6	0	E. L. Waterman B. J. Lambert	N. Sollenberger L. C. Crawford
Johns Hopkins Univ.	39	28	9	286	0	1	7	0	9	0	5	7	16	9	0	2	85	7	1	T. F. Comber, Jr.	J. M. Robertson† W. T. Ballard
Kansas State Col.	56	45	15	384	10	3	7	0	13	2	0	0	28	28	0	0	100	11	1	M. W. Furr	R. C. Regnier† W. E. Baldry
Kansas, Univ. of	31	18	9	48	6	1	5	1	8	2	0	6	7	18	0	0	74	8	0	G. W. Bradshaw	M. H. Davison† C. K. Mathews
Kentucky, Univ. of	87	65	24	2	8	9	5	0	24	1	0	25	32	24	0	0	100	4	1	W. J. Carrel	J. S. Watkins
Lafayette Col.	19	10	12	315	4	1	3	5[g]	8	0	3	2	9	5	0	0	56	5	1	E. H. Rockwell	L. M. Entrekin
Lehigh Univ.	31	19	5	35	1	0	5	0	4	3	7	5	11	8	0	0	39	9	0	H. G. Payrow	L. M. Entrekin
Louisiana State Univ.	26	16	12	200	2	2	1	0	5	1	0	1	10	15	0	0	70	6	0	F. F. Pillet	C. V. Baker
Louisville, Univ. of	15	8	9	7	6	0	2	1	1	0	0	5	6	4	0	0	71	4	0	W. R. McIntosh	W. W. Sanders
Maine, Univ. of	26	26	10	22	1	3	6	0	5	2	0	0	17	9	0	0	40	3	4	W. S. Evans	H. L. Doten
Manhattan Col.	91	44	13	1700	0	0	12	1	11	5	0	40	29	22	0	0	100	4	1	J. J. Costa	A. V. Sheridan
Marquette Univ.																					J. J. Lanigan†
Maryland, Univ. of	36	28	7	69	1	0	4	1	5	4	0	0	22	14	0	0	95	5	2	S. S. Steinberg	H. H. Allen
Mass. Inst. of Tech.	52	29	12	800	7	0	4	1	12	1	0	6	15	30	1	0	72	19	16	J. D. Mitsch	S. M. Ellsworth
Mich. Col. of Min. & Tech.	31	19	8	215	1	0	2	1	7	0	6	8	9	8	0	0	74	4	3	W. Polkinghorne	L. F. Levin
Michigan State Col.	51	31	35	80	48	2	9	1	27	0	0	5	19	27	0	0	46	7	4	C. L. Allen	H. L. Conrad
Michigan, Univ. of	56	27	13	70	1	5	5	1	12	3	0	9	12	27	8	0	51	18	0	L. C. Maugh	D. C. May
Minnesota, Univ. of																					
Mississippi State Col.	44	30	10	9	0	1	3	2	10	0	0	12	16	16	0	0	81	3	1	J. C. Bridger	N. H. Rector
Mississippi, Univ. of	24	24	7	20	0	0	4	1	7	2	5	7	6	6	0	0	50	2	1	A. B. Hargis	P. A. Sherman† F. V. Ragsdale
Mo. School of Mines & Met.	45	22	14	400	7	0	13	0	14	3	0	7	16	22	0	0	60	4	1	E. W. Carlton	C. P. Owens
Missouri, Univ. of	35	34	9	7	1	1	5	0	7	0	0	4	15	14	2	0	45	7	2	Harry Rubey	John Short† S. M. Rudder
Montana State Col.	25	..	26	0	21	0	0	5	26	0	0	2	8	15	0	0	100	1	1	L. D. Conkling	
Nebraska, Univ. of	34	21	11	75	0	2	5	0	11	5	0	4	14	15	1	0	56	4	1	H. J. Kesner	J. G. Mason J. V. Risser†

Name of Chapter	No. of Members	Aver. Attend. at Mtgs. (Members Only)	No. of Meetings	Total No. of Visitors During Year	No. of Papers or Lectures: By Students	By Faculty	By Others	Am. Soc. C.E. Illus. Lectures	No. Meetings Attended by: Fac. Adviser	Cont. Mem.	Membership by Classes: Freshmen	Sophomores	Juniors	Seniors	Grad. Stud.	Evening Stud.	% of Eligibles Who Are Members	Members of Faculty: In Soc.	Not in Soc.	Faculty Adviser	Contact Member
Nevada, Univ. of																					
New Hampshire, Univ. of	18	18	23	49	2	1	5	3	15	2	0	0	7	11	0	0	36	4	0	E. W. Bowler	L. F. Johnson
New Mexico State Col.	9	9	9	5	10	0	3	1	7	3	0	0	2	7	0	0	26	2	1	D. B. Jett	W. W. Baker
New Mexico, Univ. of	24	16	12	8	0	1	4	0	11	10	0	3	7	14	0	0	54	2	1	William Hume, II	F. W. Slattery
New York, Col. of the City of	48	33	24	90	1	1	0	1	24	0	0	0	22	26	0	0	45	17	1	C. Cunningham	D. B. Steinman
										24											W. J. Armento†
New York Univ.	81	33	18	36	0	5	6	1	16	8	0	14	19	26	0	22	68	8	1	D. Trowbridge	A. G. Hayden
										8											Vincent Cartelli†
Newark Col. of Eng.	49	34	9	33	1	1	5	0	9	3	0	21	6	15	0	7	89	6	1	W. LaLonde, Jr.	Charles Gilman
										1											R. H. Gilman†
North Carolina State Col.	52	41	14	80	2	2	2	1	6	3	0	11	17	22	2	0	95	5	2	C. L. Mann	T. S. Johnson
North Dakota State Col.	41	32	22	85	5	3	1	0	0	0	4	9	9	19	0	0	72	0	3		
North Dakota, Univ. of	18	11	8	24	2	1	1	0	7	1	0	4	5	9	0	0	90	3	1	Alfred Boyd	J. P. Kennedy
Northeastern Univ.	91	35	13	47	2	0	9	0	10	4	0	24	45	24	0	0	69	4	2	E. Gramstorff	M. N. Clair
Northwestern Univ.	18	13	6	51	0	1	1	0	5	0	0	2	12	3	1	0	43	4	2	L. T. Wyly	Albert Smith
																					H. J. Alwart†
Norwich Univ.	63	20	10	19	0	2	1	0	9	2	16	23	15	9	0	0	91	2	4	A. D. Taylor	T. W. Dix
Ohio Northern Univ.	35	27	17	..	16	1	3	0	16	0	14	4	8	9	0	0	100	1	0	A. R. Webb	F. L. Gorman
Ohio State Univ.	40	21	12	62	6	0	8	0	9	4	0	6	19	15	0	0	47	10	1	C. H. Wall	C. W. Allen
																					J. L. Monarchi†
Oklahoma A. & M. Col.	33	20	15	30	0	3	10	0	15	0	0	3	12	18	0	0	47	7	1	E. R. Stapley	V. H. Cochrane
																					Guy H. James
Oklahoma, Univ. of	34	21	10	52	4	0	5	4	10	2	0	8	14	12	0	0	61	2	2	J. F. Brookes	W. E. Price
																					H. McInerney†
Oregon State Agri. Col.	91	49	7	49	1	1	6	0	7	3	0	22	42	27	0	0	66	4	6	G. W. Holcomb	C. McCullough
Pennsylvania State Col.	69	35	13	238	11	2	5	0	12	6	20	5	16	28	0	0	66	11	5	H. N. Benkert	H. J. Crumlish
Pennsylvania, Univ. of	18	..	7	1	1	1	4	0	7	1	0	4	7	7	0	0	47	5	2	H. C. Berry	Julius Adler
Pittsburgh, Univ. of	50	46	24	..	3	4	17	1	22	0	12	15	13	10	0	0	100	3	4	L. C. McCandliss	N. B. Jacobs
Princeton Univ.	23	11	8	41	0	0	5	0	8	0	8	5	3	5	2	0	79	6	0	E. K. Timby	M. B. Case
																					H. F. Harris[c]
Purdue Univ.	103	68	6	400	0	3	3	0	5	0	0	17	29	56	1	0	55	17	6	C. A. Ellis	M. R. Keefe
Rensselaer Poly. Inst.	77	24	6	215	2	0	4	0	5	0	18	6	30	20	3	0	65	13	4	H. B. Compton	J. P. Newton
Rhode Island State Col.	24	18	11	21	4	0	3	4	7	3	0	8	9	7	0	0	89	3	0	F. W. Stubbs, Jr.	J. L. Murray
Rice Inst.	17	14	15	7	18	0	2	2	9	9	0	6	7	4	0	0	81	2	0	L. B. Ryon, Jr.	S. W. Oberg
Rose Poly. Inst.	17	16	6	9	0	2	1	1	6	1	0	5	7	5	0	0	89	3	0	R. E. Hutchins	Fred Kellam
Rutgers Univ.	23	16	6	189	1	0	3	0	6	3	3	8	6	4	2	0	64	4	2	F. C. Mirgain	Morris Goodkind
																					J. E. Crabiel†
Santa Clara, Univ. of	18	12	11	23	5	1	4	1	9	1	5	4	6	3	0	0	86	3	0	E. C. Flynn	M. H. Antonacci
S.C., Clemson A.&M. Col. of	68	37	11	27	8	2	2	0	10	1	0	24	28	16	0	0	84	5	0	H. E. Glenn	B. A. Morgan
South Carolina, Univ. of	24	14	14	10	0	1	1	1	3	0	0	3	11	10	0	0	..	3	0	W. E. Rowe	T. K. Legaré
South Dakota State Col.	37	18	7	23	1	3	2	0	6	0	17	7	8	5	0	0	77	3	0	H. B. Blodgett	J. L. Sorbill
S. Dak. State Sch. of Mines	25	15	5	8	1	0	2	1	5	2	0	8	8	9	0	0	74	2	2	E. D. Dake	A. Chenoweth
																					J. R. Clanton†
Southern Calif., Univ. of	37	26	8	0	3	2	3	0	8	1	9	12	11	0	0	0	70	3	1	R. M. Fox	W. W. Hurlbut
Southern Methodist Univ.	34	14	23	138	15	2	7	6	12	4	0	12	15	7	0	0	78	2	1	S. Thompson	L. R. Ferguson
Stanford Univ.	37	15	22	74	0	1	8	0	10	1	0	0	9	10	18	0	86	8	4	H. A. Williams	A. L. Trowbridge
																				L. B. Reynolds[a]	
Swarthmore Col.	22	..	9	..	7	0	4	0	9	1	7	10	2	3	0	0	100	2	0	S. T. Carpenter	Barclay White
Syracuse Univ.	30	22	8	11	3	0	2	0	8	1	0	9	13	8	0	0	97	5	0	C. S. Camp	G. D. Holmes
Tennessee, Univ. of	31	17	17	24	3	2	4	0	16	4	0	7	12	11	1	0	39	7	2	A. T. Granger	C. E. Nichols
										14											H. Southerland†
Texas, A. & M. Col. of	145	64	15	36	6	4	5	1	12	3	20	29	46	49	1	0	43	14	0	J. T. L. McNew	O. A. Seward
																					F. J. Benson†
Texas Tech. Col.	34	16	10	8	3	1	5	0	9	2	2	5	14	13	0	0	41	4	3	G. W. Parkhill	H. N. Roberts
Texas, Univ. of	56	28	12	60	2	2	5	1	1	1	0	4	25	26	0	0	34	10	0	J. A. Focht	P. A. Welty
Tufts Col.	28	6	5	9	2	1	2	1	4	1	1	7	10	10	0	0	68	5	1	F. H. Crabtree	J. S. Crandall
Tulane Univ.	27	18	38	576	3	3	6	2	3	0	0	10	11	6	0	0	100	3	..	D. Derickson	E. S. Bres
Union Col.	16	15	7	10	7	0	3	0	7	2	0	2	8	6	0	0	47	3	2	W. C. Taylor	H. V. Gulick
																					C. W. Davies†
Utah State Agri. Col.	94	36	21	116	7	1	8	7	5	1	24	13	23	34	0	0	100	5	0	G. D. Clyde	O. C. Lockhart
Utah, Univ. of																					
Vanderbilt Univ.	22	16	17	0	6	0	0	1	2	2	0	5	9	8	0	0	96	3	1	W. A. Coolidge	L. R. Currey, Jr.
Vermont, Univ. of	10	10	6	123	4	1	1	0	4	5	0	4	2	4	0	0	59	2	2	G. F. Eckhard	G. E. Rickard
Villanova Col.	13	13	16	27	4	3	1	7	16	2	0	4	5	4	0	0	100	2	0	J. A. Oakey	J. J. Sweeney
Virginia Mil. Inst.	184	184	10	100	29	0	0	1	10	1	0	82	66	36	0	0	100	3	3	J. A. Anderson	E. M. Hastings
																				R. A. Marr, Jr.[d]	
Virginia Poly. Inst.	46	44	20	0	8	3	1	4	6	0	0	14	16	16	0	0	43	1	3	R. B. H. Begg	F. P. Turner
Virginia, Univ. of	20																30			E. W. Saunders	A. J. Saville
Washington, State Col. of	53	26	15	40	3	3	7	0	14	14	5	12	20	16	0	0	66	3	2	H. E. Phelps	T. H. Judd
Washington Univ.	20	16	10	125	1	0	4	0	8	2	0	4	10	6	0	0	100	3	1	E. O. Sweetser	J. E. Vollmar
Washington, Univ. of	55	29	12	52	1	4	6	0	8	2	0	3	18	33	1	0	57	14	3	F. Rhodes, Jr.	W. D. Shannon
West Virginia Univ.	16	14	30	1	56	0	2	5	30	1	0	0	12	4	0	0	100	5	1		Harry O. Cole
Wisconsin, Univ. of	85	37	9	113	0	4	10	0	8	3	17	5	22	40	3	0	48	7	5	A. T. Lenz	H. O. Lord
Worcester Poly. Inst.	35	25	8	28	6	1	4	2	7	5	0	16	9	10	0	0	85	5	0	C. F. Meyer	J. A. Tosi
Wyoming, Univ. of	77	39	12	0	2	2	4	2	10	0	0	20	26	31	0	0	94	4	1	H. T. Person	E. K. Nelson
Yale University	17	13	10	1371*	.0	3	5	0	6	2	0	0	11	5	1	0	..	13	1	R. H. Suttie	C. E. Smith
																					Grant Robley†
Totals	5,328		1,480	13,816	627	175	523	118			344	1,096	1,798	1,827	134	100	73				

* Includes 1,200 at Annual Spring Engineering Exhibit.
† Junior Contact Member.
‡ Alternate Contact Member.
[a] Prof. Reynolds is Acting Faculty Adviser, as Prof. Williams is away from school.
[b] Chapter membership is limited to Junior, Senior, and Graduate students.
[c] Mr. Case is Contact Member for first term, Mr. Harris for second.
[d] Colonel Marr appointed Faculty Adviser, March 1941.
[e] Sophomores—general college students.
[f] Number of eligible Sophomores and Juniors unknown.
[g] Given in summer.

Student Chapter Annual Reports

Abstracts of 1940–1941 Reports from the Western and Northern Districts as Provided by the Society's Committee on Student Chapters. Abstracts from the Southern District Appeared in the October Issue, and Abstracts from the Eastern District Are Scheduled for December

University of Colorado

The University of Colorado reports an outstandingly successful year. Usually student papers comprise a major part of the Chapter program, but during the past year the Chapter presented a number of nationally known speakers who discussed a variety of topics. A number of interesting displays were exhibited by the Chapter at the annual Engineers' Day celebration.

The fact that most of the graduating seniors have applied for membership in the Society is evidence that the members of the Chapter are taking increased cognizance of the value of participation in Society affairs.

California Institute of Technology

During the past year there was a material increase in student interest in the California Institute of Technology Chapter. High points in the year's activities included field trips, a joint meeting with the Los Angeles Section, and an Exhibit Day to demonstrate to the public the interest and activities of the members of the Student Chapter.

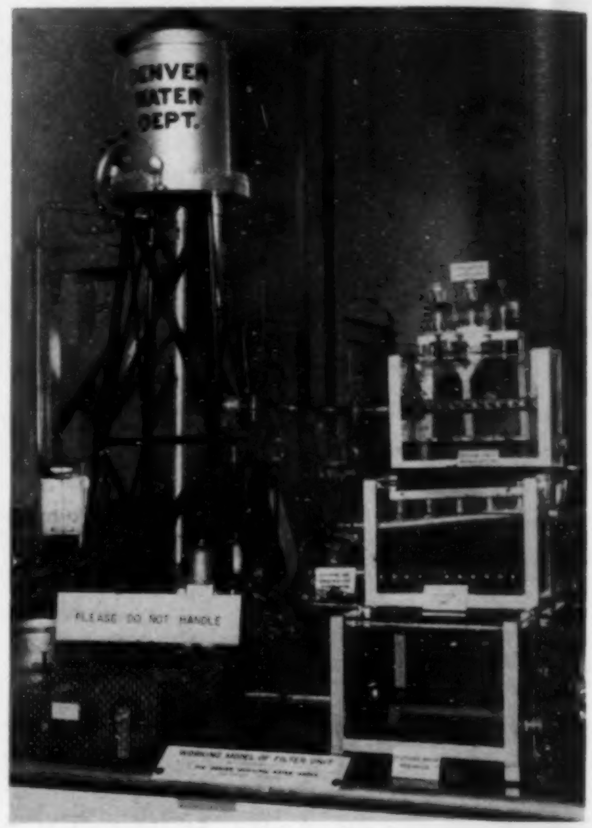
Colorado State College

The Colorado State College Student Chapter is now well organized and functioning smoothly. During the year a number of prominent engineers appeared on the program. That the graduates are becoming professionally conscious is evidenced by the fact that 17 out of 22 seniors applied for Junior membership in the Society.

University of Idaho

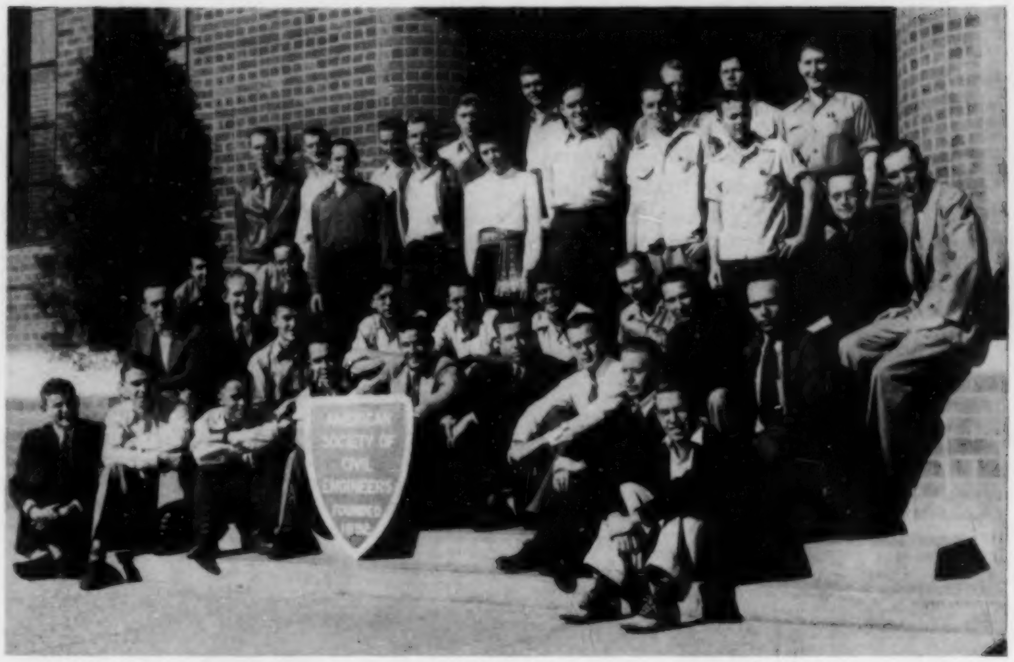
Major contributing factors to the success of the program of the University of Idaho Student Chapter were the ability of the speakers and the variety of their subjects. Talks and illustrated lectures were presented in the structural, sanitary, and highway engineering fields. Perhaps the outstanding function of the year was a joint meeting on the Idaho campus, at which the Washington State College Chapter and the Spokane Section were entertained.

Although high-pressure methods were not used, all graduating seniors have applied for Junior membership in the Society.



Working Model of Denver Filter Unit
Displayed by University of Colorado Chapter on Engineers' Day

The University of Idaho Chapter Is Host to the Washington State College Chapter and the Spokane Section



MEMBERS OF THE UNIVERSITY OF ARIZONA CHAPTER

UNIVERSITY OF ARIZONA

Recognizing the chaotic condition of the world and the current interest in national defense, the University of Arizona Student Chapter used the student engineer's place in national defense as the theme for its programs during the year. Speakers were selected with the idea of presenting various phases of this general topic.

High lights of the year's activities were an annual field trip sponsored by the Chapter, participation in two meetings of the Arizona Section and in the Roads and Street Conference, and the winning of awards for campus activities. The Chapter was the leading professional organization on the campus.

KANSAS STATE COLLEGE

A number of excellent speakers appeared on the program of the Kansas State Agricultural College Student Chapter, and the Chapter reports an interesting and profitable year. An achievement of the Chapter was the winning of a gold cup award for the outstanding exhibit at the Engineers' Open House. The central feature of the exhibit was a structural and bridge display with models and dioramas showing the development of structural engineering over a period of 2,500 years.

NEW MEXICO STATE COLLEGE

Inasmuch as most of the programs of the New Mexico State College Student Chapter are provided by the members, and academic credit is allowed for this work, attendance is compulsory for seniors. During the year, several short inspection trips were made. The civil engineering exhibit at the annual Engineers' Day exercises constituted an outstanding contribution to the success of the event.

PRIZE-WINNING MODEL OF DAM AND APPURTENANT STRUCTURES EXHIBITED BY NEW MEXICO STATE COLLEGE CHAPTER

MONTANA STATE COLLEGE

During the past year the program of the Montana State College Chapter was composed entirely of student papers and the Society's lectures. Attendance at meetings is required of juniors and seniors. Although membership in the Chapter is optional, all eligible students were members.

UNIVERSITY OF NEBRASKA

Each senior student in the University of Nebraska Student Chapter may select a member of the Nebraska Section to serve as his sponsor. The sponsor then assists the student by giving him personal advice and suggestions. This plan has resulted in much good to the Nebraska students.

On April 2 A. P. Richmond, Jr., Assistant to the Secretary, who was then engaged on a classification survey for the engineering department of the state, addressed the Chapter on "What's Ahead for the Graduate." Particular emphasis was placed on keeping up with the times, continued study after graduation, and the wisdom of devoting a part of one's income to professional advancement.

UNIVERSITY OF NEW MEXICO

During the past year, there was a marked increase in interest in the University of New Mexico Chapter. Four joint meetings with the New Mexico Section, a field inspection trip to Conchas Dam and the Tucumcari Irrigation Project as guests of the New Mexico Section, and the attendance of some of the members at the Rocky Mountain Regional Student Chapter Conference at Laramie, Wyo., stimulated interest and developed a closer relationship between students and practicing engineers. The cooperation of the New Mexico Section contributed materially to the success of the Chapter.

UNIVERSITY OF KANSAS

The enthusiasm, cooperation, and active participation of Chapter members offset a decrease in membership in the University of Kansas Chapter, which reports an enjoyable and successful year. An unusual number of excellent speakers, participation in the Mid-Continent Conference of Student Chapters at the University of Missouri, and a joint meeting with the Kansas City Section were features of the year.

UNIVERSITY OF NORTH DAKOTA

"We started the year with nine members. This has now been increased to eighteen . . .

"Included in the year's activities was a dinner meeting, at which several of the Chapter and faculty members at North Dakota

State College were guests. The annual inspection trip included the spring meeting of the Northwestern Section at Minneapolis, at which Daniel W. Mead was speaker. Inspection tours were made of the new sewage-treatment plant of the Minneapolis–St. Paul Sanitary District, and the St. Anthony Falls Hydraulic Laboratory, as well as several of the University of Minnesota engineering laboratories."

North Dakota State College

During the year the North Dakota State College Student Chapter presented a program consisting mainly of student papers. Several visits of inspection were made during the year, including a week's automobile trip through the Black Hills of South Dakota to study engineering methods used in the development of Black Hills resources. High lights of the trip included a visit to the Homestake Mine (the largest gold mine in North America) at Lead, S.Dak.; the Utah-Idaho sugar beet plant at Belle Fourche, S.Dak.; the Belle Fourche irrigation system; Orman Dam; and the South Dakota Bad Lands. Different members of the Chapter contributed interesting accounts of the various projects visited, and these were included in the annual report.

READY TO DESCEND THE ELLISON SHAFT AT THE HOMESTAKE GOLD MINE
North Dakota State College Group on Field Trip

Oklahoma Agricultural and Mechanical College

Activities of the Oklahoma Agricultural and Mechanical College Student Chapter included a joint meeting with the University of Oklahoma Student Chapter, the annual "tea sip," and the annual banquet. Smokers were enjoyed on alternate months during the school year.

University of Oklahoma

During the past year the University of Oklahoma Student Chapter had a number of interesting meetings, at most of which a speaker was heard. The meetings were conducted in an informal manner that added to the enjoyment of the occasion. During the year the members of the Chapter visited the Denison Dam on the Red River near Denison, Tex.

Oregon State College

During the past year the policy of the Oregon State Chapter has been to offer a program of technical, professional, and social development. This was accomplished by monthly meetings, Sunday breakfast meetings, organized field trips, and active participation in the social events of the college. Freedom in organization and activity has developed student initiative and leadership. C. B. McCullough, Contact Member for the Chapter, has devoted a considerable amount of time to interviews with Chapter members, especially seniors. These interviews proved to be inspiring and of much value to the students.

The Rice Institute

The activities of the past year were interesting and beneficial to the members of the Rice Institute Chapter. The technical programs consisted of papers by Chapter members, addresses by Society members, the showing of a number of films, and an inspection trip. A boat party and a barbecue comprised the social activities of the Chapter.

University of Santa Clara

The University of Santa Clara Student Chapter program for the year consisted of addresses by students, visiting speakers, and the Faculty Adviser. A joint meeting was held with the Stanford Chapter, and the Chapter also participated in meetings of the San Francisco Section. Three all-day inspection trips proved of special interest.

South Dakota State College

Due to the fact that several faculty members and a number of students entered the service of the country during the year, the South Dakota State College Student Chapter functioned under unusual handicaps. Nevertheless the Chapter enjoyed a successful year. Quarterly engineering dinner meetings sponsored by the Student Chapter were enjoyed. Perhaps the outstanding event of the year was the all-engineers' dinner meeting held on December 4, at which Vice-President James L. Ferebee spoke.

South Dakota State School of Mines

The Student Chapter at the South Dakota State School of Mines strives to bring student engineers in closer contact with actual engineering problems. The Chapter has been fortunate in securing able engineering speakers, but because of the distance of the school from large engineering projects it has been obliged to confine inspection trips to points of engineering interest in the immediate locality of the school. During the years the seniors and juniors had many opportunities to do outside work of an engineering nature.

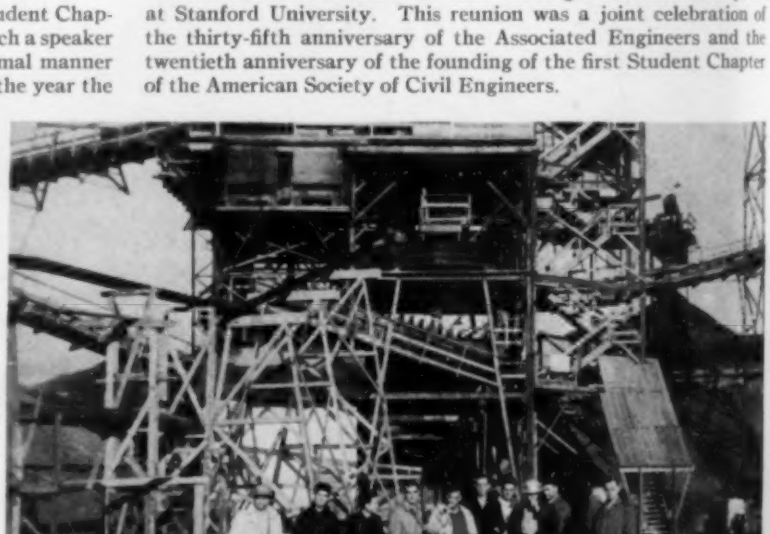
University of Southern California

"Throughout the year the University of Southern California Student Chapter carried out an interesting and varied program. The Chapter was active on the campus and organized a number of social events, which have tended to a unification of the civil engineering students and have promoted loyalty, a spirit of cooperation, and enthusiasm."

Stanford University

Business and social meetings, inspection trips, and attendance at meetings of the San Francisco Section comprised the chief activities of the Stanford University Chapter. The social meetings were both recreational and educational, and most of them were held at the homes of faculty members. Inspection trips to projects under construction added to the interest of classroom study. The Section meetings in San Francisco not only afforded the Student Chapter members an opportunity to hear excellent speakers, but also made it possible for them to meet and converse informally with prominent engineers. Often this helps the students a great deal in getting jobs upon graduation.

Other activities included a reunion of original Student Chapters at Stanford University. This reunion was a joint celebration of the thirty-fifth anniversary of the Associated Engineers and the twentieth anniversary of the founding of the first Student Chapter of the American Society of Civil Engineers.

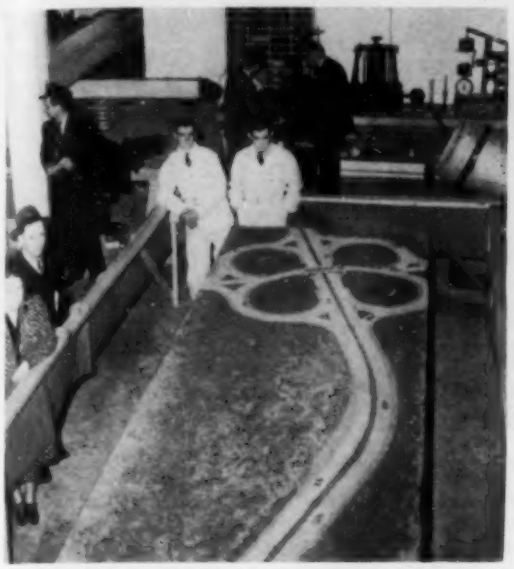


STANFORD UNIVERSITY GROUP AT FRIANT DAM AGGREGATE PLANT

Southern Methodist University

Although a young Student Chapter, the Southern Methodist University Chapter has had a long existence as a civil engineering society and therefore has traditions that are of importance in the life of any active group. The Dallas Sub-Section of the Texas Section has taken keen interest in the Chapter not only in providing speakers but in attending meetings.

A number of large federal jobs are under way in the vicinity of Dallas, with the result that opportunities for interesting and educational field trips were numerous. The Southern Methodist University Chapter was host to visiting Chapter members during the meeting of the Texas Section in Dallas and Denison.



Model Clover-Leaf Intersection Displayed by Southern Methodist University at Engineers' Open House

Texas Agricultural and Mechanical College

The Student Chapter at the Agricultural and Mechanical College of Texas enjoyed an active year. A varied program was presented by students and faculty and outside speakers. Other activities consisted of an inspection trip to Denison Dam and to Dallas, Tex., attendance at the Texas Conference of Student Chapters, a Chapter dance, a benefit show, a barbecue, participation in the Engineers' Day exercises, and a banquet to close the year's activities. The successful outcome of a number of these projects provided the sum of \$450 which was used to defray the traveling expenses of 13 students who attended the Spring Meeting of the Society in Baltimore. Numerous places of interest were visited en route, and in spite of the traveling distance involved the Chapter had the third largest delegation of students present.

Chapter at Texas
nd M. College

Texas Technological College

A smoker held early in the year served as a get-acquainted meeting. As a rule, the regular meetings throughout the year were well attended and interesting. The Chapter functioned well in its relations with other groups on the campus and was responsible for the civil engineering section in the Annual Engineer's Show. Ten members attended the Conference of Texas Student Chapters, which was held in conjunction with the spring meeting of the Texas Section.

University of Texas

Off to a good start with a get-acquainted meeting, the University of Texas Student Chapter enjoyed another successful year. The Chapter built a large sun dial on the campus in honor of Assistant Dean E. C. H. Bantel. Miscellaneous activities of the Chapter included an inspection trip to Marshall Ford Dam, a banquet and play, participation in the spring meeting of the Texas Section, and a civil engineering party.

Utah State Agricultural College

The aim of the Utah State Agricultural College Student Chapter was to provide a well-diversified program, encourage maximum participation in Chapter and school functions, and conduct Chapter affairs in a dignified manner. The senior class adopted a distinctive jacket with the Society emblem, and the Chapter teams were consistent winners in intramural sports.

There was definite improvement in Chapter activities, and the major acomplishments of the Chapter were 100% membership, wider participation in college activities, and increased prestige on the campus.

Washington State College

Technical programs for the past year at Washington State College were varied and touched numerous phases of the civil engineering field. Particular effort was made to emphasize the professional spirit of the Chapter members. As a service to the alumni and the college, the members of the Chapter are preparing a directory of all Washington State College civil engineering graduates.

University of Washington

An interesting series of lectures by outside speakers, inspection trips, a joint banquet with the Seattle Section, and an opportunity to observe at first hand the unfortunate collapse of the Tacoma Narrows Bridge made the past year eventful for the University of Washington Student Chapter. The bridge disaster emphasized dramatically the importance of proper design and stimulated interest in the more academic phases of the problem.

On May 19 and 20 the senior civil engineering class of Utah State College visited Seattle, and the University of Washington Chapter assisted in making arrangements to entertain the guests. Representatives of the Chapter and the Utah State delegation attended the annual joint banquet of the Seattle and Tacoma Sections.

Each year the University of Washington Student Chapter publishes a Society student directory.

MEMBERS AND GUESTS OF THE PENNSYLVANIA STATE COLLEGE STUDENT CHAPTER AT ANNUAL BANQUET

Pennsylvania State College

"One of the distinctive features of our Chapter, and one in which considerable pride is taken, is the publication for each meeting of a news sheet called *The Tripod*. For 12 consecutive years this publication has been edited and published by a committee of Chapter members. This year there were co-editors so that the work would be divided between two men. Publications for the meetings were prepared by each editor for alternate issues.

"Jay Risser, treasurer of the Chapter, arranged a novelty quiz program following the annual banquet. This brief battle of wits was enjoyed by all who participated. Dr. Harold Westlake, of the speech department at the college, was the guest speaker. His talk was very timely, since for the first time a speech course is to be required in the curriculum for civil engineering students."

University of Dayton

On behalf of the Dayton Section, C. H. Stephens, Contact Member for the Chapter, expressed keen interest in the Chapter and announced that two students were to be the guests of the Section at each of the monthly luncheons. All the juniors and seniors met with the Section on January 20 to hear W. F. Simpson, Ohio Valley Regional Engineer, on "Land Use and Flood Control."

The close connection between the Dayton Section and the Student Chapter goes back to 1938, when the Section feted the entire Chapter in recognition of the fact that it had earned the coveted Letter of Commendation from the President of the Society.

MEMBERS OF THE UNIVERSITY OF DAYTON STUDENT CHAPTER

The occasion was so thoroughly enjoyed that the Section voted unanimously to make the joint dinner an annual affair, complimentary to all members of the Chapter and the Section. The program for this year's dinner deviated somewhat from its usual custom of having an outside speaker. Instead four members of the Chapter presented a debate on the proposition, "That the Nations of the Western Hemisphere Should Form a Permanent Union."

University of Wyoming

The opportunity to serve as host at the Rocky Mountain Conference of Student Chapters was the high light of the year for the University of Wyoming Chapter. The total attendance of 142 included 50 Chapter members. Other activities consisted of an Engineers' Ball, Engineers' Open House, and the regular meetings. The sessions of greatest interest proved to be those at which visiting engineers addressed the Chapter. A joint meeting with the Wyoming Section and the Cheyenne Engineers Club afforded an opportunity for the Chapter members to meet practicing engineers.

Ohio Northern University

Some of the Ohio Northern University Chapter meetings were enlivened by quiz contests between the seniors and juniors of the department on engineering subjects. These contests proved very interesting and enjoyable and constitute an effective means of maintaining interest in engineering subjects.

Case School of Applied Science

During the past year the Chapter meetings at the Case School suffered from a lack of speakers. It was a difficult problem to obtain outside speakers, as so many engineers are involved in the national defense program. Thus only two outside speakers were available, and talks by faculty members and motion pictures on pertinent subjects were substituted.

University of Illinois

"Freshman Activity Night" was one of the high lights of the school year at the University of Illinois, and the Student Chapter was represented by an unusually comprehensive display. The transit and level, together with stadia boards, range poles, level rods, and other accessories, attracted much attention from members of the other schools as well as from prospective engineers. A model of Boulder Dam aroused much comment, and was a source of many questions. Blotters carrying a brief outline of the aims and activities of the Student Chapter were distributed to the freshmen.

Rensselaer Polytechnic Institute

The Rensselaer Polytechnic Institute Chapter, in its annual report, comments on the regional student conference, at which it was

MEMBERS OF THE PURDUE UNIVERSITY STUDENT CHAPTER

a reward for work done upon these two projects a social was held for all civil engineering students.

PURDUE UNIVERSITY

"The Purdue University Chapter has been very active during the past year in promoting better feeling between the students and the faculty. The purpose of the Student Chapter as set forth in the Manual for Student Chapters is 'to afford the beginnings of professional associations.' The Purdue Chapter has done this very well by having many speakers who are prominent in the field of civil engineering as guest speakers. The Chapter also fosters the presentation of engineering papers by the student members . . . .

"Every Civil from Purdue is required to go to summer surveying camp for two months during one of his vacations. This camp is a great aid in making the School of Civil Engineering the best-knit school on the campus."

Special features included a get-together meeting in the fall and the annual civil engineering banquet held in the spring, at which the Chapter is host to the Indiana Section.

UNIVERSITY OF WISCONSIN

"The University of Wisconsin Student Chapter has just completed a very successful and spirited year. Characterized by the enthusiastic and active participation of its members in the affairs of the civil engineering school as well as the entire engineering college, the Chapter has made important progress. The meetings were made attractive by the combination of a diversified program of talks, several banquets, and an inspection trip. Bulletin board announcements, notices in the daily school paper, and short talks in the classrooms provided effective publicity. The number of visitors and faculty in attendance at the meetings is indicative of the well-rounded and interesting programs, which were made possible only by the earnest effort put forth by the officers and the fine cooperation received from the members and faculty.

"The success of the annual Engineering Exposition of the College of Engineering was due in no small part to the participation of the Chapter . . . . The Chapter sponsored about ten exhibits . . . of practical as well as technical interest . . . . Of special interest was the water supply exhibit showing the relation of scientific water-softening methods to soap and linen savings."

host during the past year: "The Cornell Chapter requires its members to give a talk on their summer experiences. The Clarkson and Syracuse Chapters have annual dinners with good speakers. The Union College Chapter boasted of the annual meeting, held at Professor Taylor's farm, which is quite successful. The Rensselaer Chapter spoke of increasing the membership dues for the coming year to $1.50 and giving each member a Society badge (student grade)."

MICHIGAN STATE COLLEGE

The Michigan State College Chapter reports variation from the ordinary meetings in the form of bowling in the winter and soft-ball games in the spring. Bowling contests between the faculty and students were held once a week. These gatherings proved very enjoyable and helped materially to promote a closer student-faculty relationship. The soft-ball games were started when the "Civils" issued a challenge to the other engineering groups on the campus. The challenge was taken up and resulted in several good games.

CARNEGIE INSTITUTE OF TECHNOLOGY

"We continued our program of weekly meetings, interspersed with inspection trips. The size of the enrollment in our department at Carnegie Institute makes it possible for us to carry on a program which we feel is unique. During the first semester, prominent engineers in the Pittsburgh region are secured as speakers. During the second semester, each senior presents a talk in lieu of a thesis. The student is expected to do research for his talk, and prepare it in written form, just as he would for a thesis. But, in addition, he presents it orally before the other members of the Chapter."

MICHIGAN COLLEGE OF MINING AND TECHNOLOGY

This year the Student Chapter won the first prize of $15 for the best snow statue—of a highway arch bridge—at the annual winter carnival. In the parade the Chapter also won second prize of $10 with a float entitled "Civil Engineers Forging Ahead." A large anvil was built around a student who sat with only his head showing. Two students with sledge hammers stood nearby. As

STUDENT CHAPTER AT THE UNIVERSITY OF WISCONSIN

ITEMS OF INTEREST

About Engineers and Engineering

CIVIL ENGINEERING for December

FLEXIBILITY in sewage treatment for army camps is the subject of a paper by Prof. Rolf Eliassen, Associate Professor of Sanitary Engineering at New York University. Of vital importance to the country is the proper treatment and disposal of sewage in the large new camps being constructed to house our growing army. Many of these camps are in the South, where high temperatures and swampy ground make the problem more complex. This is a practical as well as a theoretical matter with Professor Eliassen because he is now acting as sanitary engineer for the firm of Parsons, Klapp, Brinckerhoff and Douglas, who are actively engaged in this work for our armed forces.

In an allied field is the paper by George L. Hall, chief engineer of the Maryland State Department of Health, telling of the precautions that make it possible to eat Chesapeake Bay oysters and shellfish without danger of typhoid. A large group of people around Chesapeake Bay earn their living in this industry and these shellfish are used over a wide area in the eastern part of the United States. Pollution would have far-reaching and disastrous effect and the work described by Mr. Hall is of an importance far beyond the technical field.

Unique construction work is described by Anton Tedesko in his paper, "Wide-Span Hangars for the U.S. Navy." These monumental hangars made of arching concrete illustrate a case where design was modified to facilitate and cheapen the form work. As a result the finished structures were completed at a minimum cost and maximum speed. If release of this paper it secured from the Navy Department it will be included in the December issue.

Foundation studies for the proposed harbor steam plant in the City of Los Angeles is described in a paper by W. F. Swiger. In order to build this large structure on fill deposited as a result of dredging work in the harbor, it was necessary to make extensive foundation tests. Special apparatus was set up, and the results dictated the building foundations now under construction.

In addition there will be other papers on a variety of subjects, including several from Society meetings.

Réthi Pencil Drawings on Page of Special Interest

WE ARE again fortunate to be able to reproduce some of Miss Lili Réthi's excellent engineering drawings. The reproductions on this month's Page of Special Interest show some of the operations entailed in moving a steel-framed brick-faced 5-story building a distance of 60 ft to make way for the new East River Drive in New York City. A detailed description of this operation is given in the article by Charles B. Spencer, M. Am. Soc. C.E., on page 659 of this issue.

Miss Réthi has specialized in sketching engineering subjects, thereby making her work especially adaptable to our CIVIL ENGINEERING publication. See Pages of Special Interest for March and September 1941 for other examples of her work.

Edwin H. Colpitts Becomes Director of Engineering Foundation

ON October 1, Dr. Edwin H. Colpitts became Director of the Engineering Foundation, succeeding the late Otis E. Hovey, Hon. M. Am. Soc. C.E.

A Canadian by birth, Dr. Colpitts was educated at Harvard University, where he taught in the early years of his career. From 1899 to 1907 he was with the American Telephone and Telegraph Company, and from the latter year until 1917 served as research engineer for the Western Electric Company, in New York City. He was assistant chief engineer of the latter company until 1924, when he returned to the American Telephone and Telegraph Company as assistant vice-president. After ten years in this capacity he became vice-president to the Bell Laboratories, serving until his retirement in 1937.

Widely known for his telephonic inventions and for his researches in telegraphy and telephony, Dr. Colpitts is the author of numerous works on these subjects. His various technical affiliations include membership in the American Institute of Electrical Engineers.

Free Lecture Program at Columbia University

THE Department of Civil Engineering at Columbia University has just announced the current program of the Hydraulic and Fluid Mechanics Colloquium, which it has been sponsoring for several years. These meetings are open, free of all fees and formalities, to engineers and others interested in keeping in touch with recent trends, researches, and developments in the field of advanced hydraulics, fluid mechanics, and hydraulic engineering. The lectures are given by eminent authorities in this field and are followed by open discussion. The program for the current year includes:

October 21—Boris A. Bakhmeteff, Professor of Civil Engineering, Columbia University.

November 18—William P. Creager, Consulting Engineer, Buffalo, N.Y.

December 16—Fred C. Scobey, Irrigation Engineer, U.S. Department of Agriculture, and Chairman, Hydraulics Division, Am. Soc. C.E., Denver, Colo.

January 20—Robert T. Knapp, Associate Professor of Hydraulic Engineering, California Institute of Technology, Pasadena, Calif.

The meetings are held in Room 402 of the Engineering Building, at 8:00 p.m. Inquiries should be addressed to the secretary, Department of Civil Engineering, Engineering Building, Columbia University, New York, N.Y.

Prof. N. G. Neare's Column

Conducted by

R. ROBINSON ROWE, M. AM. SOC. C.E.

"WE ENGINEERS," said Professor Neare, "are noted for our respect for fact. Two months ago I propounded a problem suggested by a confidential report from my European correspondent, Alenfer de l'Axe, reflecting on communiqués of contradictators (which still are concocted from the same ingredients of propaganda, premature conclusion, blind or bland exaggeration, and wishful or wistful thinking). The fact of this report was somewhat elusive. Did any of you find it?"

"I for one," answered Joe Kerr. "The general captured only 144 Slavs, but hid the pitiful number behind the word 'horde.' When one escaped from the square phalanx, the others could be arranged in 13 equal groups or in a column of elevens. The correspondent's name is my sentiment, exactly."

"Mine, too," agreed Cal Klater, "but there were more Slavs. Those 13 equal groups had to be square groups, because the column was 13 times as long as it was wide. So the conditions may be expressed:

$$x^2 - 1 = 13a^2 = 11b \qquad (1)$$

"The first equality is a Diophantic in Pellian form, for which there are an infinitude of solutions (besides the obvious $x = 1$). The least does not qualify; for the next, a is divisible by 11, giving the number of Slavs (x^2) as 709,639,444,801. So the general claimed to have captured the entire population of Russia 4,000 times over!"

"That explains why I missed the bus," put in Amos Keatow. "I tried all squares up to 16,000,000, the strength of the Slav army, but none would work. So I gave up after 17 nights of frustration."

"You make the general too modest," added one of our Life Members. "All the conditions can be encompassed by the one equation:

$$x^2 - 1 = 1{,}573b^2 \qquad (2)$$

for which Cal has given the least solution

I like the next larger, which is 2,014,352,-566,467,047,545,939,201."

"I won't choose between them," replied the Professor, "but let me read you a letter, for what it's worth:

Blitzkrieg H. Q., Gozhskdarnski, 74 July 1941

Prof. N. G. Neare, New York, N.Y., U.S.A.

Sir:

IT'S A LIE!!!!

Heil.

My agents short-wave from my secret North American station that it has been reported to you that my army captured only 709,639,444,801 Slavs. Some say 2,014,352,566,467,047,545,939,-201. Lies!! The captives really numbered 5,717,-856,147,600,551,577,114,920,334,955,963,201!

Heil.

This is seen immediately by the substitution of 2 (my lucky number) for n in the Slavindicator:

$$\left[(n+1)\sum_{i=0}^{n+1}(-1)^i\frac{(2n-i+1)!}{i!(2n-2i+2)!}\,1{,}298^{2n-2i+2}\right]^2 \quad \ldots.(3)$$

Heil.

Every one of them was a communist.

Heil.

And the one who got away had red whiskers.

Heil.

Resp'y.,
Adolph

P.S. My army is incredible; so am I.

Via diplomathematic courier.

"Incidentally the letter was postmarked 'Pittsburgh.' His general solution is excellent, but I prefer my Slavaddemupper:

$$\left[\sum_{i=0}^{n}\frac{(2n)!}{(2n-2i)!(2i)!}\,421{,}200^i \times 421{,}201^{n-i}\right]^2 \quad \ldots.(4)$$

"Tonite we have an old friend in the role of Guest Professor—J. W. Pickworth, the creator of Mac McMack. The floor is yours, Professor Pickworth."

"Thank you, Noah. Even tho you allow two months, my problem is one that must be and was solved in two minutes and without pencil or slipstick. Hiram Flire, the army scout, was 16 miles north of his base headed west when he grazed another plane, jamming his rudder in a two-mile-radius left turn. In the next two minutes Hi flew a complete circle; in the same two minutes he figured how to fly home. Neglecting deceleration for landing, at how many minutes after the accident did Hi Flire's wheels touch the ground at his base?"

[*Cal Klater is two precise first-nighters—Richard Jenney and Frederick Pohle. The Life Member is David E. Hughes. There were 15 Joe Kerrs, two of whom withdrew by the next post. Adolph, incredibly, chose anonymity. Professor Neare has mimeoed 5 solutions to Eqs. 1 and 2, showing derivation of Eq. 4—available to the first 100 at cost (5 cents postpaid).*]

Brief Notes

IN view of the existing national emergency, six national engineering societies have joined to organize the Engineers' Defense Board. This organization will act as a central agency in providing the various branches of the country with engineering knowledge and experience on questions connected with military preparedness. The cooperating groups, in addition to the four Founder Societies, are the Society of Automotive Engineers and the American Institute of Chemical Engineers.

* * * *

PREVIOUS issues of CIVIL ENGINEERING have listed members of the Society who were awarded honorary degrees during the past commencement season. The Society has now had word of two members honored this fall. On October 3 Henry S. Jacoby, Hon. M. Am. Soc. C.E., received the honorary degree of doctor of engineering from Lehigh University at the celebration of the seventy-fifth anniversary of the founding of the university. Professor Jacoby is an alumnus of the class of 1877. In recent months, also, Maj. Gen. Eugene Reybold, newly appointed Chief of Engineers of the U.S. Army, received the honorary degree of doctor of engineering from his alma mater, the University of Delaware.

NEWS OF ENGINEERS

Personal Items About Society Members

STILL more members of the Society in the Officers Reserve Corps of the Army have been called to active duty. The list includes Maj. Oliver D. Keese, from office engineer in the Department of County Surveying and Engineering, Los Angeles, Calif., to the Headquarters of the West Coast Air Corps Training Center, Moffett Field, Calif.; Capt. Lloyd H. Flickinger, from Diablo Heights, Canal Zone, to the Office of the Constructing Quartermaster on the construction of the Kansas Ordnance Plant at Parsons, Kans.; and Lt. Richard L. Powell, from assistant traffic engineer for Dallas, Tex., to the Office of the Constructing Quartermaster at Fort Sam Houston, Tex.

Similarly, in the U.S. Naval Reserve there are Lt. Comdr. Charles W. Nash, from the U.S. Engineer Department at Anchorage, Alaska, to the 13th Naval District at Seattle, Wash.; Lt. Deane E. Carberry, from associate engineer for the U.S. Bureau of Reclamation at Denver, Colo., to the 12th Naval District at San Francisco, Calif.; Lt. Frank B. Cressy, from associate highway engineer for the California State Department of Public Works, Los Angeles, Calif., to the headquarters of the 11th Naval District at San Diego, Calif.; Lt. James S. Marsh, from naval architect for W. C. Nickum and Sons, of Seattle, Wash., to the Naval Ammunition Depot at Burns City, Ind.; Lt. George N. Newhall, from assistant highway engineer for the U.S. Forest Service at San Francisco, to the Bureau of Yards and Docks in Washington, D.C.; Lt. Lloyd E. Root, from the Virginia Engineering Company at Newport News, Va., to the Bureau of Yards and Docks in Washington, D.C.; Lt. William L. Sawyer, from associate professor of civil engineering at the University of Florida, Gainesville, Fla., to the Naval Air Station at Jacksonville, Fla.; Lt. Robert S. Thomas, from associate engineer for the U.S. Bureau of Reclamation at Sacramento, Calif., to the 12th Naval District at San Francisco; Lt. Roscoe E. Van Liew, from associate engineer for the U.S. Bureau of Reclamation at Salt Lake City, Utah, to the Bureau of Yards and Docks in Washington, D.C.; and Lt. Abraham Verduin, from assistant engineer in the structural division of the Public Service Electricity and Gas Company, Newark, N.J., to the Norfolk Navy Yard at Portsmouth, Va.

CARL D. POLLOCK has established a general consulting practice in Tacoma, Wash. Until recently he was chief engineer of the Public Service Commission, at Frankfort, Ky.

HAYWOOD G. DEWEY, JR., after a year spent in hydraulic research in various parts of the country as Freeman Traveling Scholar for 1940–1941, has returned to his position as assistant engineer for the U.S. Bureau of Reclamation at Denver, Colo.

EUGENE P. FORTSON, JR., captain, Corps of Engineers, U.S. Army, has been transferred from the 106th Engineers, Mississippi National Guard, Camp Blanding, Fla., to the Office of the Under Secretary of War in Washington, D.C. Before he was called to active duty Captain Fortson was in the U.S. Waterways Experiment Station at Vicksburg, Miss.

W. S. WALKER has resigned his position as consulting engineer for the Chamber of Commerce of Pittsburgh (Pa.) in order to become supervisor of the engineering mechanics courses at Pennsylvania State College.

ARTHUR S. HOBBY, for the past several years state supervisor of the New Jersey Stream and Waterways Survey, has been appointed Area Planning Engineer for the New Jersey section of the Public Works Reserve.

HENRY H. JEWELL is now project director for Smith, Hinchman and Grylls, Inc., and Toltz, King and Day, Inc., architects and engineers, on the construction of the Twin Cities Ordnance Plant at St. Paul, Minn. Until recently he was office engineer for A. Guthrie and Company and the Al Johnson Construction Company on the construction of the Iowa Ordnance Plant at Burlington, Iowa.

DAVID F. GIBONEY, formerly district director of the WPA at Long Island City, N.Y., has been appointed director of the new WPA Division of Training and Reemployment.

FRANK R. BURNETTE has been promoted from the position of construction superintendent for the Carnegie-Illinois Steel Corporation, Pittsburgh, Pa., to that of assistant chief engineer.

FREDERICK H. MCDONALD has resigned as industrial and development engineer for the South Carolina Public Service Authority in order to resume his private

consulting practice. He will open offices at 1 Broad Street, Charleston, S.C.

JOHN KLORER, of New Orleans, La., is now supervising engineer of the engineering division of the Reconstruction Finance Corporation, with headquarters in Washington, D.C.

CHARLES H. MOTTIER, for the past six years assistant to the vice-president and chief engineer of the Illinois Central Railroad, Chicago, Ill., has been made chief engineer.

ARTHUR F. PERRY, JR. lieutenant commander, Civil Engineer Corps, U.S. Navy, has been transferred from the Naval Air Station at Jacksonville, Fla., to the Bureau of Yards and Docks in Washington, D.C.

A. C. CLARKE is now chief engineer of the Baltimore and Ohio Railroad, succeeding the late HARRY A. LANE. Until lately he was assistant chief engineer.

ALFRED H. BAUM, JR., a member of the architectural and engineering firm of Baum and Froese, of St. Louis, Mo., has been appointed to the post of Building Commissioner of St. Louis.

BERTRAM P. THOMAS recently resigned as chief engineer of the Inter-County River Improvement Commission, Sumner, Wash., in order to accept a national defense position with the Corps of Engineers, U.S. Army, at Seattle, Wash.

J. A. MCCONNELL has been appointed Northeastern Regional Director for the Public Works Administration, with headquarters in Boston, Mass. He was formerly chief resident engineer inspector for the PWA at Everett, Mass.

HUGH J. CASEY, lieutenant colonel, Corps of Engineers, U.S. Army, has been ordered to duty with the United States Forces in the Far East and will be stationed at Manila, Philippine Islands. He was previously with the 10th Engineers at Fort Lewis, Wash.

WARDNER G. SCOTT, formerly head of the firm of Scott and Scott, of Lincoln, Nebr., has been made Nebraska state highway engineer.

K. C. MCFARLAND was recently appointed civil and hydraulic engineer in connection with the preparation of plans for an $11,000,000 hydroelectric project at Tacoma, Wash.

RAY WARREN has resigned as city engineer and chief building inspector of Greensboro, N.C., in order to accept an appointment as executive director of the Greensboro Public Housing Authority.

JAMES GIRAND, previously city engineer of Phoenix, Ariz., has accepted a position as office engineer for Leeds, Hill, Barnard and Jewett (Los Angeles consulting engineers) on cantonment construction at Santa Maria, Calif.

HAROLD C. HICKMAN is now head of the flood control and hydraulic engineering section of the U.S. Engineer Office at Detroit, Mich.

J. L. LAND, materials engineer for the Alabama State Highway Department at Montgomery, has accepted a position with the federal government in Washington, D.C.

FREDERICK B. DUIS retired on October 31 after many years in the civilian employ of the U.S. Engineer Office. Mr. Duis entered the service as a surveyman in 1895 and, at the time of his retirement, was principal engineer at Cincinnati, Ohio.

THOMAS P. LYNCH, chief engineer of grade-crossing elimination for the New York Central Railroad at Dunkirk, N.Y., has been appointed resident engineer on the construction of a $6,000,000 army depot to be erected near Albany, N.Y. WALTER L. MORSE, special assistant engineer for the New York Central in New York City, will succeed Mr. Lynch at Dunkirk.

O. Y. LEONARD, of the New York engineering firm, Lewis and Leonard, is now job engineer in Bermuda for F. H. McGraw and Company, contractors.

HARVEY L. VINCENT recently resigned as director of public works at Greenbelt, Md., in order to accept a position as assistant engineer with Lummus Company, contractors for the Maumelle Ordnance Works near Little Rock, Ark.

CARL HUGO WALTHER has been promoted from the position of instructor in civil engineering at George Washington University to that of assistant professor of civil engineering.

E. N. NOYES has resigned as chief engineer for the Eighth Construction Zone of the Quartermaster Corps, U.S. Army, in order to return to his private practice. Mr. Noyes is moving to Corpus Christi, Tex., where he will handle the Corpus Christi office of his engineering firm, Myers and Noyes of Dallas.

C. E. S. BARDSLEY is now on the staff of the Office of Engineering, Science, and Management Defense Training of the United States Office of Education, Washington, D.C. He is also lecturing in the evening school at George Washington University. Professor Bardsley was formerly in the engineering department at Oklahoma Agricultural and Mechanical College and, at the same time, maintained a consulting practice at Stillwater, Okla.

THOMAS ANDREW JORDAN, assistant engineer of the American Bridge Company, Chicago, Ill., has been appointed assistant division engineer of the Western division of the company. He succeeds F. W. DENCER, who is retiring after forty years of continuous service with the organization.

EDWARD R. LACY until recently junior sanitary engineer in the Health and Safety Department of the TVA at Kingston, Tenn., has been appointed assistant sanitary engineer in the Reserve Corps of the Public Health Service. He is to be a member of the Malaria Control Commission to be sent to China to work on the malaria problem arising in connection with the construction of the Burma-Yunnan Railroad.

GEORGE F. STROLLO has been promoted from the position of instructor in civil engineering at George Washington University to that of assistant professor of civil engineering.

FRANCIS M. BELL, district engineer for the U.S. Geological Survey at Atlanta, Ga., has been transferred to the Chattanooga (Tenn.) Office of the Survey, where he will be district engineer of the Water Resources Branch. He is being succeeded at Atlanta by M. T. THOMSON, who has been associate engineer for the Survey at Boston, Mass.

GEORGE K. LEONARD, formerly construction engineer for the Tennessee Valley Authority on Cherokee Dam, has been made project manager on the Hiwassee Project, the most recent defense undertaking of the TVA.

DECEASED

CHARLES MELVIN ADAMS (M. '28) pioneer engineer of Bellingham, Wash., died there on August 31, 1941, at the age of 81. Long active in engineering work in the West, he had served several terms as city engineer of Bellingham and as county engineer and surveyor of Whatcom County. Later (1927 to 1929) he served as municipal engineer in charge of the construction of a huge water-works and sewerage system in Santo Domingo City (now Ciudad Trujillo, Dominican Republic).

The Society welcomes additional biographical material to supplement these brief notes and to be available for use in the official memoirs for "Transactions."

GEORGE ELLSWORTH BARROWS (M.'17) valuation engineer of Buffalo, N.Y., died on September 24, 1941. For over thirty years Mr. Barrows was a member of the Buffalo engineering firm of Ellsworth, Barrows and Reeves.

LOUIS FREDERIC BUFF (Affiliate '38) president and director of the Buff and Buff Manufacturing Company, Jamaica Plain, Mass., died in Boston, Mass., on August 29, 1941. Mr. Buff, who was 65, had been with Buff and Buff since 1907. Earlier in his career he was in the employ of the New York, New Haven and Hartford Railroad.

ALFRED DICKEY BUTLER (M. '19) city engineer of Spokane, Wash., died there on September 14, 1941, at the age of 63. Mr. Butler became principal assistant city engineer of Spokane in 1910 and was city engineer from 1917 on, except for a period during the World War when he served in the Quartermaster Corps of the U.S. Army.

EDWARD RICHARD CARY (M. '02) professor emeritus of geodesy and road engineering at Rensselaer Polytechnic Institute (Troy, N.Y.), died at his home at

Columbia, S.C., on July 17, 1941. He was 75. Professor Cary went to Rensselaer in 1888 as an instructor in surveying—from 1902 to 1904 was assistant professor of surveying and from 1904 until his retirement in 1936 held a full professorship. He was the author of several widely-used engineering textbooks and, while teaching, had served two terms as city engineer of Troy.

HERBERT SAMUEL HOLT (M. '89) president of the Montreal Light and Power Company, Montreal, Canada, died in that city on September 28, 1941. Sir Herbert, who was 85, was noted as a railroad builder, his most important work in that field being for the Canadian Pacific. At one time he was president of the Royal Bank of Canada.

ELMOUR FITCH KIRTLAND (Assoc. M. '16) who was with the Salem Engineering Company, of Salem, Ohio, died in that city on September 14, 1941. Mr. Kirtland, who was 71, was connected with the American Bridge Company for forty years—as structural engineer at Youngstown, Ohio, and later at Ambridge, Pa. He retired in 1935, but returned to active work a year ago.

CHARLES HEES LEDLIE (M. '88) retired civil engineer of St. Louis, Mo., died on June 25, 1941. Mr. Ledlie devoted most of his professional career to a consulting practice in St. Louis. He retired some years ago.

JOHN HERBERT MCMANUS (M. '28) who retired in February as chief of the Bureau of Claims of the New York City Board of Water Supply, died in Kingston, N.Y., on September 6, 1941. He was 59. Except for a year of teaching at the Massachusetts Institute of Technology, his alma mater, Mr. McManus spent his entire career with the Board of Water Supply, having gone there in 1907.

THOMAS PETTIGREW (M. '93) retired civil engineer of Asheville, N.C., died on April 28, 1941, though word of his death has just reached the Society. He was 82. Early in his career Mr. Pettigrew was with the Baltimore and Ohio Railroad and the Great Northern Power Company at Duluth, Minn. In 1908 he entered the service of the American Ice Company in New York City, retiring as chairman of the Board in 1932.

VOLNEY RICHARD SEAWELL (M. '40) director of the Division of Operations of the WPA at Los Angeles, Calif., died in that city on September 21, 1941. From 1904 to 1928 Mr. Seawell was assistant engineer for the city of Los Angeles, and from 1929 to 1934 construction superintendent for the Macco Construction Company at Clearwater, Fla. More recently he had been resident engineer inspector for the PWA.

CARLETON WILLIAM STURTEVANT (M. '01) retired civil engineer of Atlanta, Ga., died there on September 16, 1941, at the age of 77. Mr. Sturtevant had, at various times, maintained a consulting practice in New York City and was noted as the designer of the hydraulic dredge boats used in digging the Panama Canal. During the World War he served overseas with the rank of colonel, supervising construction of the large military camp at Gieueres, France.

JAMES SYKES (Assoc. M. '18) chief engineer for the Great Western Railway at Loveland, Colo., died on August 31, 1941, at the age of 57. Born and educated in England, Mr. Sykes came to this country as a young man and, in 1907, began his career with the Hudson and Manhattan Railway in New York City. Later he went West, and from 1916 on was with the Great Western Railway.

FRANK STONE TAINTER (M. '08) died at his home in Far Hills, N.J., on September 25, 1941, at the age of 79. Colonel Tainter, who was for many years associated with the firm of Parsons, Klapp, Brinckerhoff and Douglas in New York City, was engaged on important construction projects throughout the country. During the World War he served with the Corps of Engineers, with the rank of lieutenant colonel, and was stationed at Aberdeen, Md., testing ordnance for several years.

EDWIN VAN GOENS (Assoc. M. '33) assistant structural engineer in the bridge division of the Los Angeles (Calif.) Bureau of Engineering, died on August 30, 1941. Mr. Van Goens, who was 40, had spent most of his career in the employ of the City of Los Angeles—for a time as topographical draftsman and junior engineer in the Sewer Department.

Changes in Membership Grades

Additions, Transfers, Reinstatements, and Resignations

From September 10 to October 9, 1941, Inclusive

ADDITIONS TO MEMBERSHIP

ALSMEYER, WILLIAM CARL (Jun. '41), Instr., Civ. Engr., Missouri School of Mines (Res., 705 West 12th St.), Rolla, Mo.

APSEY, FREDERICK WILLIAM, JR. (Jun. '41) (Galesburg Constr. Co.), 315 Bank of Galesburg, Galesburg, Ill.

ARMSTRONG, DONALD PAUL (Jun. '41), 4224 Sixteenth, N.W., Washington, D.C.

BALKEMA, JOHN EDWARD, JR. (Jun. '41), Civ. Engr., Bates & Rogers Constr. Corp., Box 412, La Porte, Ind.

BARTHOLOW, JACK WHARTON (Jun. '40), Engr., Brown & Root, Inc. (Res., 7812 Adrian St.), Houston, Tex.

BISHOP, R. B. (Assoc. M. '41), Asst. Hydr. Engr., Special Eng. Div., The Panama Canal, Diablo Heights, Canal Zone.

BOGARDUS, ROBERT KENT (Jun. '41), Field Engr., Drydock Associates, Norfolk Navy Yard (Res., 36 Alden Ave.), Portsmouth, Va.

BOURNE, WILLIAM HUNT (Jun. '41), Draftsman, Newport News Shipbuilding & Drydock Co. (Res., 305 Enterprise, Ferguson Park), Newport News, Va.

BOYARIN, DAVID (Jun. '41), Asst. Eng. Aide, TVA, Box 406, Gilbertsville, Ky.

BRAKEFIELD, CHARLES MARTIAL, JR. (Jun. '41), Ensign, U.S.N.R., 917 Wyomina St., Ocala, Fla.

BREEDLOVE, JOHN CROMWELL (Assoc. M. '41), 1013 South Logan St., Moscow, Idaho.

BRENNAN, WILLIAM RAYMOND (Assoc. M. '41), Engr., Am. Petroleum Co., Petroleum Bldg., Houston, Tex.

BROOKSHIRE, ROBERT RAYMOND (Jun. '41), With Company B, 89th Engr. Battalion, U.S. Army, Fort Leonard Wood (Res., 109 South Pine St., Rolla), Mo.

BURCHARD, JOHN ELY (M. '41), Director, Albert Farwell Bemis Foundation, Mass. Inst. Tech., Cambridge, Mass.

BURDMAN, IRVING (Assoc. M. '41), Associate Civ. Engr., 11th Naval Dist., Ft. of Broadway (Res., 4654 Fiftieth St.), San Diego, Calif.

CAIN, MORRISON GRIFFIN, JR. (Jun. '41), 43 Wendell St., Cambridge, Mass.

CAMPBELL, GEORGE RODGERS (Jun. '41), Care, Office Eng. Div., The Panama Canal, Administration Bldg., Balboa Heights, Canal Zone.

TOTAL MEMBERSHIP AS OF OCTOBER 9, 1941	
Members	5,729
Associate Members	6,704
Corporate Members	12,433
Honorary Members	32
Juniors	4,478
Affiliates	68
Fellows	1
Total	17,012

CANTON, JOHN AXTELL (M. '41), Asst. Designing Engr., Boston Elevated Ry., 31 St. James Ave., Boston (Res., 69 Cedar Rd., Belmont), Mass.

CARR, JOE MATT (Assoc. M. '41), Agri. and Mech. College of Texas, Box 2514, College Station, Tex.

CONKEY, CHARLES ROLLAND (M. '41), Vice-Pres. and Gen. Mgr., Fegles Constr. Co., Ltd., 711 Wesley Temple, Minneapolis, Minn.

DATE, RICHARD FOSTER (Jun. '41), Box 147 Cordova, Alaska.

DAWSON, LEWIS DECKER, JR. (Jun. '41), Junior Engr., Magnolia Petroleum Co., Box 900 (Res., 721 Browder St.), Dallas, Tex.

DEL MASTRO, ANTHONY JOSEPH (Jun. '41), 74 Sterling Ave., Jersey City, N.J.

DIBBLE, WORTHAM WYATT (Jun. '41), Care, Traffic Eng. Div., State Highway Dept., Columbia, S.C.

DONLEY, RUSSELL LEE (Jun. '41), Instr., Civ. Eng., Univ. of Wyoming, Eng. Bldg., Laramie, Wyo.

DRESTE, JEROME PHILIP (Jun. '41), Engr., Long Lines Plant Dept., Am. Tel. and Tel. Co., 1010 Pine St., St. Louis (Res., 302 East Argonne, Kirkwood), Mo.

ESPY, JAMES BRUCE (Jun. '41), 6335 East 17th Ave., Denver, Colo.

FORD, NATHANIEL (Jun. '41), 209 1/2 Virginia, Baytown, Tex.

FREESE, JAMES OTIS (Jun. '41), Lt., 47th Field Artillery, U.S. Army, Fort Bragg, N.C.

FRIEDENBACH, KENNETH JOSEPH (Jun. '41), 587 Twenty-fourth St., Oakland, Calif.

GARTNER, WILBUR HAROLD (M. '41), Chf. Engr., Chas. W. Cole & Son, 220 West La Salle Ave., South Bend, Ind.

GILMONT, JOHN ALEXANDER (Assoc. M. '41), Asst. Engr., U.S. Bureau of Reclamation, Dept. of Interior, 200 Old Post Office Bldg., Sacramento, Calif.

GRIFFITH, JOHN MACK (Jun. '41), Soils Testing Engr., W. S. Housel, 1224 East Eng. Bldg. (Res., 133 Fairview St.), Ann Arbor, Mich.

HARDINE, KENNETH LAVERNE, JR. (Jun. '41), Junior Hydr. Engr., Water Resources Branch, U.S. Geological Survey, Box 138 (Res., 104 East 10th St.), Rolla, Mo.

HUBBARD, LEONARD SARGENT (Assoc. M. '41), Hydrographic and Geodetic Engr., U.S. Coast and Geodetic Survey, 307 Custom House, San Francisco, Calif.

JAFFESS, HERBERT (Jun. '41), 150 Bennett Ave., New York, N.Y.

JOHANEK, JOHN ALTON (Jun. '41), Junior Bridge Engr., Bridge Dept., State Div. of Highways, Box 1499, Sacramento (Res., 120 Plaza Ave., North Sacramento), Calif.

KETTLER, ALFRED WILLIAM, JR. (Jun. '41), Lt. U.S. Army, 3104 Beaver Ave., Fort Wayne, Ind.

KINNEY, JOHN ERWIN (Jun. '41), 208 Farm St., Ithaca, N.Y.

KOTECKY, HARRY ALOYSIUS (Assoc. M. '41), Asst. Civ. Engr., U.S. Engrs., 550 Federal Bldg. (Res., 1202 Bascome St.), Mobile, Ala.

KRULL, ROBERT ALWIN (Jun. '41), Asst. Project Engr., State Highway Comm., 311 East Washington St., Sullivan, Ind.

LEWIS, ALBERT DALE MILTON (Jun. '41), Central Y.M.C.A., Toledo, Ohio.

LIEB, JOHN JUNIOR (Jun. '41), Corp., 185th Field Artillery, 34th Div., U.S. Army, Camp Claiborne, La. (Res., Atkins, Iowa.)

LONG, JACK YERVANT (Jun. '41), Structural Draftsman, D. R. Warren, Architects Bldg., Los Angeles (Res., 1630 East 2d St., Long Beach), Calif.

McGURK, SAMUEL ROGERS (Jun. '41), Junior San. Engr., State Board of Health, 1098 West Michigan, Indianapolis, Ind.

McKELLAR, HUGH ARCHIBALD (Jun. '41), Junior Engr., U.S. Bureau of Reclamation, Provo (Res., 857 Pierpont Ave., Salt Lake City), Utah.

MAYNARD, FREDERICK ALEXANDER (Assoc. M. '41), Junior Civ. Engr., SCS, Ukiah, Calif.

MILLER, SHANON ERNEST (M. '41), Constr. Engr., Austin Bridge Co., 1813 Clarence St., Dallas, Tex.

NORDELL, CHARLES ARTHUR (Jun. '41) With Glenn L. Martin (Res., 3415 Brendan Ave.), Baltimore, Md.

MYERS, CLARENCE HAROLD (Jun. '41), 21 Rosedale Ave., Greenville, Pa.

NELSON, WILLIAM BONNEAU (Assoc. M. '41), Associate Engr., U.S. Engrs., Hernando, Miss.

NEWTON, RALPH WILLIAM (Assoc. M. '41), Project Engr., PWA, Federal Works Agency, 2141 Interior Bldg., North, Washington, D.C. (Res., Evanston Hotel, Evanston, Ill.)

NOBLE, GILBERT GEORGE (Jun. '41), Associate Engr., State Highway Comm., 2141 Kansas Ave., Topeka, Kans.

NORDIN, CLARENCE WALDEMAR (Jun. '41), Material Lister, Estimating Dept., Austin Co., Sand Point Naval Air Station (Res., 2429 West 60th St.), Seattle, Wash.

PERKINS, MAC DUDLEY (M. '41), Cons., Civ. and Structural Engr., 110 Sutter St., San Francisco, Calif.

PETERS, STANLEY BRODRICK (Jun. '41), Rodman, Engr. Apprentice, P. R. R., Walnut St. (Res., 339 South 3d St.), Coshocton, Ohio.

PIERCE, GEORGE NORMAN (Assoc. M. '41), Asst. Hydr. Engr., TVA, 515 Union Bldg., Knoxville, Tenn.

PIETZ, DAVID (Jun. '41), Transitman, Pacific Gas & Elec. Co., 245 Market St., San Francisco (Res., 354½ Mill St., Grass Valley), Calif.

PITCHFORD, CHARLES WESLEY (Jun. '41), Looper, Bethlehem Steel Co., Keim St. (Res., 333 Rosedale Drive), Pottstown, Pa.

PITZ, WILLOTT ARTHUR (Jun. '41), Junior Engr., McMullen & Pitz Constr. Co., 923 Commercial St. (Res., 822 Hawthorne Terrace), Manitowoc, Wis.

PRATT, AVERY JUDSON (M. '41), Vice-Pres., R. S. McManus Steel Constr. Co., Inc., 1254 East Ferry St., (Res., 356 Parker Ave.), Buffalo, N.Y.

RASCH, HARRY BLANDFORD (M. '41), Water Treatment Engr., International Filter Co., 325 West 25th Pl., Chicago (Res., 196 Fairfield Ave., Elmhurst), Ill.

REILLY, RAYMOND THOMAS (M. '41), San. Engr., Whitman, Requardt & Smith, Arsenal Project, Huntsville, Ala.

SALTZSTEIN, IRVING DAVID (Assoc. M. '41), Constr. Engr., A. O. Smith Corp., 3533 North 27th St. (Res., 5067 North Lake Drive), Milwaukee, Wis.

SCHRENK, GEORGE STAEHLE (Jun. '41), Junior Engr., Barnard, Godat & Heft, 314 Terminal Station Bldg. (Res., 4634 Toulouse St.), New Orleans, La.

SCHWARTZ, MILTON (Jun. '41), Junior Civ. Engr., U.S. Engrs., War Dept., U.S. Engr. Office, Rome, N.Y.

SCHWENDIMAN, GLENN (Jun. '40), Asst. Traffic Engr., Chicago Motor Club, 66 East South Water St., Chicago, Ill.

SERRA, JULIUS HERSCHEL (M. '41), Res. Engr., Geo. H. Flinn Corp., 551 Fifth Ave., New York (Res., 88 Quinlan Ave., Staten Island), N.Y.

SHARLOW, CHARLES RAYMOND (Jun. '41), Structural Draftsman, Am. Bridge Co., Elmira (Res., 122 West 12th St., Elmira Heights), N.Y.

STEWART, GORDON AUGUSTUS (Jun. '41), Instr., Structures Div., The Ground School, Naval Air Station, Pensacola, Fla.

STONE, JOHN AUGUST (Jun. '41), Senior Engr., Bridge Office, State Dept. of Roads and Irrig., State Capitol (Res., 1310 C St.), Lincoln, Nebr.

TATUM, JOHN HERVEY (Jun. '41), Junior Engr. (Civ.), U.S. Engr. Dept., Box 84, Oxford, Miss.

TAYLOR, DONALD BURDETTE (Jun. '41), With Glenn L. Martin Aircraft Co. (Res., 3431 Cliftmont Ave.), Baltimore, Md.

THOMPSON, PAUL CHARLES (Assoc. M. '41), Box 84, Diablo Heights, Canal Zone.

TOMANN, KENNETH JOHN (Jun. '41), Draftsman, Dry Dock Engrs., Inc., 27 William St., New York (Res., 39-20 Fifty-fifth St., Woodside), N.Y.

ULUSHAHIN, MUZAFFER OK (Jun. '41), 1504 S St., Lincoln, Nebr.

URBAN, WILLIAM JOHN (Assoc. M. '41), Sales Engr., The Falk Corp., 3001 West Canal St., Milwaukee, Wis.

VANDENBURGH, EDWARD CLINTON, JR. (M. '41), Engr. of Maintenance, C. & N.W. Ry., 400 West Madison St., Chicago, Ill.

VERMILYA, JAMES LEWIS (Jun. '41), Junior Engr., U.S. Engr. Dept., Sub-Office, New Castle, Pa. (Res., 105 West Penn St., Muncy, Pa.)

VILLEMONTE, JAMES RICHARD (Jun. '41), Instr. and Research Associate, Hydraulics and Hydrology, Dept. of Civ. Eng., Pennsylvania State College, State College, Pa.

VON TOBEL, GEORGE WOODRUFF (Jun. '41), Junior Engr., U.S. Engrs., 217 South 1st, Las Vegas, Nev.

VOORHEES, JOHN CULVER (Assoc. M. '41), Associate Civ. Engr., TVA, 303 Arnstein Bldg., Knoxville, Tenn.

WALTHER, WILLIAM EDWIN (Jun. '41), Junior Naval Archt., Puget Sound Navy Yard (Res., 95 Galyan Drive, Apt. A), Bremerton, Wash.

WARNER, WALLACE PAYSON (Jun. '41), 2d Lt., 9th Coast Artillery, Battery B, U.S. Army, Fort Banks, Mass.

WARREN, ROBERT ALEXANDER (Jun. '41), With Charles De Leuw Co., 20 North Wacker Drive, Chicago (Res., 313 South York St., Elmhurst), Ill.

WILKIE, CHARLES BALDWIN (Assoc. M. '41), Project Engr., The H. K. Ferguson Co., 1650 Hanna Bldg., Cleveland (Res., 2515 Cypress Way, Norwood), Ohio.

WILLIAR, HARRY DUGAN, JR. (M. '41), Administrator, WPA, 1100 Baltimore Trust Bldg., Baltimore, Md.

YOUNG, CHARLES MELL (Jun. '41), Junior Draftsman, E. I. du Pont de Nemours & Co., Inc. (Res., 1010 Jefferson St.), Wilmington, Del.

ZUKOWSKI, HENRY MIECZYSLAW (Assoc. M. '41), Asst. Engr., Greeley & Hansen, 6 North Michigan Blvd. (Res., 2210 Walton St.), Chicago, Ill.

MEMBERSHIP TRANSFERS

BUTLER, EARLE BENNETT (Jun. '35; Assoc. M. '41), 1st Lt., Corps of Engrs., War Dept., Asst. Project Engr., Tyndall Field (Res., 322 Massalina Drive), Panama City, Fla.

CARBERRY, DEANE EDWIN (Jun. '30; Assoc. M. '41), Lt. (jg), CEC, U.S.N.R., 12th Naval Dist., San Francisco (Res., 670 Hilldale Ave., Berkeley), Calif.

CLIFFE, LUTHER ELIOT (Jun. '30; Assoc. M. '41), Associate Engr., U.S. Bureau of Reclamation, Coulee Dam, Wash.

COHEN, BENJAMIN CARL (Jun. '32; Assoc. M. '41), Engr., Dry Dock Engrs., 27 William St., New York (Res., 32-28 One hundred and fifty-ninth St., Flushing), N.Y.

CRAVENS, JAMES WADE (Jun. '39; Assoc. M. '41), Junior Res. Engr., State Highway Dept., Paris, Tex.

CROMER, ORLAND DWIGHT (Jun. '36; Assoc. M. '41), Asst. Civ. Engr., U.S. Fish & Wildlife Service, Box 94, San Antonio, N.Mex.

CURTIS, DONALD DEXTER (Assoc. M. '27; M. '41), Prof., Mechanics and Hydraulics, Clemson College, Clemson, S.C.

DUNHAM, JAMES WARING (Jun. '31; Assoc. M. '41), Associate Engr., U.S. Engr. Office, 751 South Figueroa St., Los Angeles, Calif.

FOOTE, FRANCIS SELLEY (Assoc. M. '12; M. '41), Prof., Railroad Eng., Univ. of California (Res., 2607 Shasta Rd.), Berkeley, Calif.

FOX, JEFF STANLEY (Jun. '39; Assoc. M. '41), Asst. Engr., Thackwell & Fox (Res., 410½ Walnut St.), Little Rock, Ark.

HALLOCK, HARRY EARNEST (Jun. '32; Assoc. M. '41), Asst. Engr., State Highway Testing Laboratory, Ohio State Univ., Columbus, Ohio.

JOHNSON, WENDELL EUGENE (Jun. '31; Assoc. M. '41), Prin. Engr., Special Eng. Div., Panama Canal, Diablo Heights, Canal Zone.

JUDD, FRANK RHYMAL (Assoc. M. '09; M. '41), Engr., of Buildings, Ill. Cent. System, 135 East 11th Pl., Chicago, Ill.

KIKER, JOHN EWING, JR. (Assoc. M. '36; M. '41), Dist. San. Engr., State Dept., of Health, 35 Market St., Poughkeepsie, N.Y.

KLOTZ, RUSSELL LOUIS (Assoc. M. '28; M. '41), Engr., Special Eng. Div., Panama Canal, Diablo Heights, Canal Zone.

MACFARLAND, LESTER BURTON (Jun. '31; Assoc. M. '41), 225 North Central Ave., Wollaston, Mass.

MALE, MILTON (Jun. '28; Assoc. M. '33; M. '41), Research Engr., U.S. Steel Corp. of Delaware, 436 Seventh Ave., Pittsburgh, Pa.

MILES, THOMAS KIRK (Jun. '34; Assoc. M. '41), Engr., Shell Development Co., 4560 Horton St., Emeryville (Res., 11 La Plaza, Orinda), Calif.

NIXON, DANIEL DECATUR (Jun. '37; Assoc. M. '41), Res. Engr., State Highway Dept., Lampasas, Tex.

O'DONNELL, HERBERT PRESTON (Jun. '36; Assoc. M. '41), Junior Bridge Engr., State Div. of Highways, Box 1499, Sacramento (Res., 303 Chestnut St., Lodi), Calif.

REARDON, LESLIE JOSEPH (Assoc. M. '37; M. '41), Engr., Caribbean Archt. Engr., Army Post Office 803, Port of Spain, Trinidad.

ROBERTS, KENNETH CLARK (Assoc. M. '31; M. '41), Prin. Mech. Engr., TVA, Union Bldg., Knoxville, Tenn.

ROGERS, JOHN WILLARD (Jun. '35; Assoc. M. '41), Asst. Gen. Supt., Bates & Rogers Const. Corp., Box 412 (Res., 114 South Ave.), La Porte, Ind.

SCHULCZ, JOSEPH ANDREW (Jun. '30; Assoc. M. '41), Structural Designer, W. Herbert Gibson, Architects Bldg., Philadelphia (Res., 520 Spruce Ave., Upper Darby), Pa.

SHANNAHAN, GEORGE DAVID (Jun. '32; Assoc. M. '41), Contr., Shannahan Brothers Inc., 6193 Maywood Ave., Huntington Park (Res., 4923 Vistadeoro Ave., Los Angeles), Calif.

STEVENSON, ALBERT LESTER (Assoc. M. '19; M. '41), (Elwyn E. Seelye & Co.), 101 Park Ave., New York (Res., 18 Ivy Way, Port Washington), N.Y.

STUBBS, JAMES ARMSTRONG (Jun. '31; Assoc. M. '41), Asst. Engr., Research, U.S. Bureau of Reclamation, Dept. of Interior, 20 Custom House, Denver, Colo.

REINSTATEMENTS

AXTHELM, FREDERICK AUGUST, Assoc. M., reinstated Sept. 15, 1941.

JOHNSON, NATHAN CLARKE, M., reinstated Oct. 3, 1941.

KLEINSCHMIDT, ROBERT BAUMGARTNER, Jun., reinstated Sept. 22, 1941.

LAWRENCE, JOHN HEYER, Assoc. M., reinstated Sept. 9, 1941.

REMBEN, PETER, Assoc. M., reinstated Sept. 29, 1941.

RESIGNATIONS

ERICHSEN, FRANK PETER, Jun., resigned Oct. 8, 1941.

Applications for Admission or Transfer

Condensed Records to Facilitate Comment from Members to Board of Direction

November 1, 1941 — Number 11

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every member is urged, therefore, to scan carefully the list of candidates published each month in Civil Engineering *and to furnish the Board with data which may aid in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should be promptly communicated to the Board.

Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

Grade	General Requirement	Age	Length of Active Practice	Responsible Charge of Work
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years RCM*
Associate Member	Qualified to direct work	27 years	8 years	1 year RCA*
Junior	Qualified for sub-professional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years RCM*

* In the following list RCA (responsible charge—Associate Member standard) denotes years of responsible charge of work as principal or subordinate, and RCM (responsible charge—Member standard) denotes years of responsible charge of IMPORTANT work, i. e., work of considerable magnitude or considerable complexity.

APPLYING FOR MEMBER

Altieri, John Richard, Washington, D.C. (Age 47) (Claims RCM 17.2) June 1941 to date Chf., Bldgs. and Structures Unit, Office of Quartermaster General, Constr. Div., Repairs and Utilities Branch, U.S. War Dept.; Aug. 1940 to June 1941 Operator Bldr., Developer and Cons. Engr.; previously with U.S. Housing Authority as Senior Management Constr. Engr., and Senior Constr. Engr.; Liaison Constr Supervisor, Housing Div. PWA.

Baird, Joseph Henry, Joliet, Ill. (Age 41) (Claims RCA 6.0 RCM 12.7) Nov. 1940 to date Head, Structural Div., Sanderson & Porter; Jan. to Nov. 1940 Consultant on private work for various clients; previously with Slattery Contr. Co., New York City, as Engr.-Estimator, and Cons. Engr.; also with A. P. James, Brooklyn, N.Y., as Engr.

Buck, Horace Miller (Assoc. M.), Radford, Va. (Age 43) (Claims RCA 1.5 RCM 8.8) Sept. 1940 to July 1941 Chf Engr., Radford, Mason and Hanger Co., Inc., and July 1941 to date Gen. Supt. for Mason and Hanger; previously with Silas Mason Co., Inc. New York World's Fair 1939, and Merritt, Chapman and Scott.

Burnham, Raymond, Chicago, Ill. (Age 59) (Claims RCA 16.8 RCM 18.1) Feb. 1941 to date with Day & Zimmermann, Inc., Engrs., Philadelphia, as Prin. Structural Engr. for Iowa Ordnance Plant, Burlington, Iowa; Jan 1939 to Feb. 1941 Eng. Specialist for Chicago (Ill.) Board of Education; previously in partnership on structural design, etc.

Chambers, Harold Joseph Ashbridge, Hamilton, Ont., Canada. (Age 39) (Claims RCA 6.2 RCM 6.6) May 1940 to date Chf. Engr., Hamilton (Ont.) Bridge Co., Ltd.; previously with Canadian Bridge Co., Ltd., Windsor, Ont., as Structural Detailer, Checker, Asst. Engr., and Designing Engr.

Davis, LeRoy Milton (Assoc. M.), Holtwood, Pa. (Age 41) (Claims RCA 3.0 RCM 12.6) Feb. 1930 to date Hydraulic Test Engr. Pennsylvania Water & Power Co.

Duffill, Hugh Perrins, Duxbury, Mass. (Age 43) (Claims RCA 5.5 RCM 13.8) June 1941 to date Dist. Structural Engr., Portland Cement Association; Sept. 1940 to June 1941 Structural Designer, Stone & Webster Eng. Co.; previously Cons. Engr. (Civil and Structural) in private practice.

Hanson, Ross Arnold, Champaign, Ill. (Age 55) (Claims RCA 12.6 RCM 9.9) Dec. 1937 to date City Engr., Supt. of Bldg. Constr. and Traffic Engr.; May 1936 to Sept. 1937 Engr.-Economist, RA, U.S. Dept. of Agriculture; previously Engr.-Appraiser, FCA, St. Louis.

Kern, Thomas Francis, Little Rock, Ark. (Age 44) (Claims RCA 7.4 RCM 13.1) June 1918 to date with U.S. Army in various capacities, since Feb. 1935 as Commander, Company, 2d Engrs. (4 years), Head, Eng. Div., Little Rock Engr. Dist. (1$^{1}/_{10}$ years), and since Dec. 1940 Dist. Engr.

Kringel, August Emil, Milwaukee, Wis. (Age 56) (Claims RCA 12.0 RCM 12.0) May 1927 to date Special Eng. Designer, Bureau of Engrs., Milwaukee.

Liddle, George Frederick (Assoc. M.), Muskegon Heights, Mich. (Age 40) (Claims RCA 2.3 RCM 12.4) May 1933 to date City Manager and City Engr.

McDonald Lewis, Chicago, Ill. (Age 57) (Claims RCM 30.0) June 1910 to date with Chicago Bridge & Iron Co., as Draftsman Chf. Draftsman Sales Engr., Dist. Sales Mgr., and (since 1931) Asst to Vice-Pres.

Mumford, Frank Morris, Ft. Smith, Ark. (Age 40) (Claims RCA 0.7 RCM 6.1) Oct. 1940 to date with Black & Veatch, Kansas City, Mo., as Inspector, Chf Engr. and Inspector, Asst. Engr. and Co-Designer; previously (short periods) with various pipe-line companies, etc.; City Engr., County Engr. and County Surveyor, York, Nebr.

Myott, Erme Burttle, Boston, Mass. (Age 44) (Claims RCA 4.0 RCM 12.0) April 1918 to date (except Aug. to Dec. 1918 with U.S. Army) with Fay, Spofford & Thorndike as Draftsman, Designer, Res. Engr., Senior Engr. and (at present) Project Engr.

Paul, Charles Eugene, Johnstown, Pa. (Age 41) (Claims RCA 5.5 RCM 8.3) Nov. 1932 to date with U.S. Engr. Office, as Inspector, Jun. Engr., Office Engr., Asst. Engr., Associate Engr., and (since May 1941) Project Engr.

Peterson, Carl August, Hastings-on-Hudson, N.Y. (Age 44) (Claims RCA 10.5 RCM 10.0) April 1941 to date Asst. to Director of Public Bldgs., Dept. of Public Works; previously Asst. Engr., Dept. of Hospitals and Dept. of Public Works, New York City.

Rossi Frank Joseph, Modesto, Calif. (Age 50) (Claims RCA 7.2 RCM 14.8) Nov. 1919 to date with City of Modesto, Calif., as Office Engr. and Chf. Draftsman, Asst. City Engr. and Asst. Supt. of Water-Works, and (since Jan. 1927) City Engr. and Mgr. of Public Works and Utilities.

Suehrstedt, Henry George (Assoc. M.), Sandusky Ohio (Age 43) (Claims RCA 5.1 RCM 11.3) March 1941 to date Res. Engr., E. B. Badger & Sons Co.; Sept. 1940 to March 1941 with East Moline (Ill.) Housing Authority in complete charge of supervision of construction; previously General Partner, Stark Constr. Co., Cedar Rapids Iowa; with PWA, Chicago, as Res. Engr. Inspector, Chf. Res. Engr. Inspector Engr. Examiner, and Senior Engr. Examiner.

Williams, Tudor Rosser (Assoc. M.), Scranton, Pa. (Age 60) (Claims RCA 4.5 RCM 31.0) Sept. 1921 to date Registered Prof. Engr. in private practice as Consultant, Designer and Supervisor of construction.

Wilson, Guthlac (Assoc. M.), London, England. (Age 39) (Claims RCA 6.7 RCM 6.4) Nov. 1940 to date Director of Constructional Design, Ministry of Works and Bldgs.; previously Divisional Supt., Designs Div., Sir Alexander Gibb & Partners, Cons. Engrs.; Personal Asst. to Karl Terzaghi; with Braithwaite, Burn & Jessop Constr. Co.

Wurts, William Alfred Dubois (Assoc. M.), Hartford, Conn. (Age 38) (Claims RCA 4.8 RCM 9.7) 1925 to 1930 Jun. Asst Engr. and Senior Asst. Engr., and 1937 to date Asst. City Engr., Dept. of Eng., City of Hartford, also Deputy Mgr. (ex-officio) being Executive Officer of Dept. of Eng.; in the interim Deputy Mgr., Bureau of Public Works, The (Hartford) Metropolitan Dist.

APPLYING FOR ASSOCIATE MEMBER

Acton, Joseph Paul (Junior), New York City (Age 32) (Claims RCA 2.0 RCM 3.3) March 1940 to date Engr. Inspector, Board of Water Supply, New York City, Delaware Aqueduct, Shaft 16; Sept. 1939 to March 1940 Engr Inspector, Madigan-Hyland, Long Island City; previously Jun. Engr., New York Central R.R., New York City.

Bishop, Paul Lepage, Vallejo, Calif. (Age 39) (Claims RCA 17.0 RCM 1.1) Aug. 1941 to date with City Engr., Vallejo, Calif., as Field Engr.; previously Asst. State Director, Community Sanitation, U.S. Public Health Service.

Bowen. William Cabon, Spartanburg, S.C. (Age 39) (Claims RCA 6.0) Jan. 1939 to date Engr Spartanburg Water-Works; previously Capt. Engr Res. U.S. Army; Engr. with FERA Spartanburg

Brightbill, Linwood James, Seattle, Wash. (Age 32) (Claims RCA 2.7) Aug. 1940 to date Structural Designer, Siems Drake Puget Sound; June to Aug. 1940 Draftsman (Architectural), Mock & Morrison Archts., Tacoma Wash.; previously Draftsman, The Bonneville Project, Portland, Ore., Structural Designer Boyum Schubert, & Sorensen, Archts. Winona Minn and La Crosse, Wis.; Draftsman Board of Park Commrs., Minneapolis; Structural Draftsman, Bridge Dept., Northern Pacific Ry., St. Paul, Minn.

Burke, Robert Wayland (Junior), Columbus Ohio. (Age 32) (Claims RCA 3.2 RCM 2.0) Feb. 1941 to date 1st Lieut., U.S. Army (since April 1941 with Corps of Engrs.); April 1940 to Feb. 1941 Field Engr., R. G. LeTourneau Inc., Peoria, Ill.; previously Subway Rodman, City of Chicago, Dept. of Subways and Traction; etc.

Cabell, Roy Edward, Holbrook, Ariz. (Age 38) (Claims RCA 6.2) Aug. 1928 to date with U.S. Geological Survey as Jun. Hydr. Engr., Acting Office Engr., Asst. Hydr. Engr., and (since March 1940) Asst. Engr.

Campbell, Jack P, Louisiana, Mo. (Age 39) (Claims RCA 9.8) July 1934 to Sept. 1937 and July 1941 to date with U.S. Army, as Capt. Engr.-Res., and (since July 1941) Major, Corps of Engrs.; July 1938 to July 1941 Associate Hydr. Engr., U.S. Engr. Dept.

Cartelli, Vincent Robert (Junior), New York City. (Age 30) (Claims RCA 4.6) June 1941 to date Asst. Engr., U.S. Engr. Office, War Dept., New York City; June 1940 to June 1941 Designing Engr., successively with Carbide & Carbon Chemicals Corporation, South Charleston, W.Va., M. W. Kellogg Co. and Chemical Const. Corporation, both of New York City; previously Structural Steel Draftsman (Structural Engr.), Dept. of Borough

Works, Borough President of Manhattan; Designing Draftsman, Gibbs & Hill, Inc.

DAVIS, JOHN SWIFT (Junior), Prattville, Ala. (Age 32) (Claims RCA 6.1 RCM 1.0) May 1939 to date Asst. Civ. Engr. (Project Engr.), Alabama Highway Dept.; previously Jun. Civ. Engr., U.S. Forest Service.

DOWNS, LEONARD VAUGHN (Junior), Coulee Dam, Wash. (Age 33) (Claims RCA 2.2) Sept. 1931 to date with U.S. Bureau of Reclamation as Jun. Engr., Asst. Engr., and (since Aug. 1938) Associate Engr.

FIELDS, KENNETH E (Junior), Vicksburg, Miss. (Age 32) (Claims RCA 1.0 RCM 2.0) Sept. 1939 to date Director, U.S. Waterways Experiment Station; Dec. 1937 to Sept. 1939 graduate student; previously Asst. to Dist. Engr., U.S. Engr. Office, New York City.

FOGG, CHARLES HARLEY, Concord, N.H. (Age 36) (Claims RC 12.1 D 1.4) June 1933 to date with New Hampshire Highway Dept., successively as Draftsman, Squad Leader, and Specification Writer.

GREER, DAVID MCKAY (Junior), Houston, Tex. (Age 33) (Claims RCA 9.0) July 1939 to date Asst. Engr. (under supervision), Soils Laboratory, U.S. Engr. Office; previously Development Engr., American Instrument Co., Silver Springs, Md.

HALL, MELVIN HENRIC CLEMET, Seattle, Wash. (Age 30) (Claims RCA 3.9) June 1941 to date Draftsman, Boeing Aircraft Co.; Sept. 1940 to June 1941 Student; previously Trail Locator, Dept. of Interior; Party Chf., South Dakato State-Wide Highway Planning Survey.

HART, HAROLD CARTER (Junior), Hartford, Conn. (Age 32) (Claims RCA 1.4) July 1931 to May 1934 and Sept. 1936 to date with Water Bureau, Metropolitan Dist. of Hartford County, Conn., as Draftsman, Senior Civ. Engr., and (since March 1937) Asst. Designing Engr.

HAYDEN, GEORGE GUNDERSON (Junior), Mt. Vernon, N.Y. (Age 33) (Claims RCA 3.2) Feb. 1940 to date with Portland Cement Association, New York City; March 1939 to Feb. 1940 Eng. Asst., New York City Board of Water Supply, Kerhonkson, N.Y.; previously Chf. of Party, Dept. of Public Bldgs. and Offices, Borough of Queens, Long Island City, N.Y.; with Gibbs & Hill, New York City, Cons. Engrs. for Pennsylvania R.R.

HOCKERSMITH, FORREST DAVITTE, Arlington, Va. (Age 35) (Claims RCA 2.3 RCM 1.1) Oct. 1938 to date Asst. Engr., Associate Engr., and Engr., Office of the Chf. Engr., WPA, Washington, D.C.; previously with WPA on statistical work, etc.

KIRCHMAN, MILTON FREDERICK, Brooklyn, N.Y. (Age 31) (Claims RCA 4.2) 1941 to date Eng. Draftsman, Caribbean Archt.-Engr., New York City; previously Asst. in Architecture, New York University School of Architecture; Archt., Dept. of Hospitals, Div. of Eng., New York City.

KLYCE, ERSKINE WATKINS (Junior), Dayton, Ohio. (Age 28) (Claims RCA 5.4 RCM 0.2) June 1939 to date Constr. Engr., Roberts and Schaefer Co.; March 1937–April 1939 Field Engr., Portland Cement Association; previously Res. Engr., Freeland, Roberts & Co.

KOFOID, ORVILLE (Junior), Bremerton, Wash. (Age 32) (Claims RCA 2.8) Aug. 1940 to date Chf. Eng. Aide and (at present) Asst. Civ. Engr., Public Works Dept., Puget Sound Navy Yard; previously Instructor in Civ. Eng., Oregon State Coll.; with Oregon State Highway Comm., as Chainman, Levelman, Computer, Res. Bridge Engr., Transitman, and Draftsman.

LUDLOW, JAMES HERBERT, Kansas City, Mo. (Age 40) (Claims RCA 8.8 RCM 7.4) Sept. 1936 to Jan. 1941 Res. Engr. Inspector, and Sept. 1941 to date Engr. Examiner, Kansas City (Mo.) Regional Office, PWA; in the interim Engr., U.S. Engrs., War Dept.

MACCONNELL, RICHARD JOSEPH (Junior), Pittsburgh, Pa. (Age 32) (Claims RCA 4.4) Feb. 1940 to date Asst. Hydrologic Engr., U.S. Weather Bureau; Dec. 1938 to Jan. 1940 Asst. Hydr. Engr., U.S. Forests Service; previously Senior Hydrographer, Pennsylvania Dept. of Forests and Waters; Jun. Engr., U.S. Geological Survey.

MCGREW, FINLEY OLIVER, JR., Portland, Ore. (Age 28) (Claims RCA 2.3) Feb. 1939 to date with U.S. Army Engrs., as Senior Topographic Draftsman, and (since Jan. 1941) Asst. Engr.; previously with Oregon State Highway Dept., Salem, Ore., as Chainman, Instrumentman, and Computer.

MADSEN, LYNN SPENCER, Bahrien Island, Persian Gulf. (Age 27) (Claims RCA 2.0) June to Sept. 1936 and Sept. 1937 to June 1938 with Standard Oil Co. of California, and June 1938 to date with California Arabian Standard Oil Co., as Draftsman, Surveyor and Computer, and (since June 1938) Jun. Field Engr.; Jan. to Sept. 1937 Computer and Steel Detailer, Structural Steel and Forge Co.

MAHON, JUSTIN DAVID (Junior), Newburgh, N.Y. (Age 33) (Claims RCA 4.1 RCM 0.6) July 1940 to date Eng. Inspector (Grade 4), Board of Water Supply, New York City; Feb. 1939 to June 1940 Eng. Asst., New York City Tunnel Authority; previously Civ. Engr., Underpinning & Foundation Co., New York City.

MONTNEY, ORMAND HOMER, Louisville, Ky. (Age 42) (Claims RCA 0.5 RCM 2.4) Aug. 1940 to date Chf. Structural Engr., Shreve, Anderson & Walker, Archts. & Engrs., Detroit; previously Draftsman with George D. Mason Associates, and Bigelow-Liptak Corporation, Detroit; Asst. Res. Engr. Inspector, and Res. Engr. Inspector, PWA, Detroit, Mich.

MOORE, WILLIAM WALLACE (Junior), Los Angeles, Calif. (Age 29) (Claims RCA 2.9 RCM 1.4) May to Nov. 1938 and April to Dec. 1939 Asst. Engr., U.S. Engr. Office, Los Angeles; in the interim and since Jan. 1940 member of firm, Dames & Moore, Cons. Foundation Engrs.

MUNZ, OLIVER WESLEY (Junior), Seattle, Wash. (Age 32) (Claims RCA 4.3) July 1940 to date Lieut (j.g.), CEC, USNR, on active duty at Seattle Wash., as Asst. Res. Officer; previously with Regional Office No. 9, U.S. Forest Service, Milwaukee, Wis. as Topographic Draftsman and Asst. Civ. Engr.

NIEBUHR, THEODORE WILLIAM, Trinidad, B.W.I. (Age 31) (Claims RC 6.3 D 0.6) Sept. 1940 to March 1941 Asst. Engr., War Dept., C.Q.M.C., New York City; Feb. 1941 to date also, Engr., Caribbean Archt. Engr.; previously Engr. with Interamerica, Inc., Highway Engrs. and Contrs., and Constr. Aggregates Corporation; Chf. of Party, Supt. of Constr., and Engr., CWA-PWA, Dept. of Parks, Bronx, N.Y.

PETERSON, DEAN FREEMAN, JR. (Junior), Western Port, Md. (Age 28) (Claims RCA 1.7 RCM 1.2) Aug. 1940 to date with Upper Potomac River Comm., as Asst. Project Engr., and (since Feb. 1941) Project Engr.; Sept. 1939 to June 1940 Instructor in Gen. Eng., Univ. of Washington; previously Jun. Hydr. Engr., U.S. Geological Survey; Jun Road Engr., U.S. Indian Service.

RIEDESEL, GERHARD A., Moscow, Idaho. (Age 37) (Claims RCA 5.1 RCM 1.2) Nov. 1940 to date (on leave from Bureau of Highways) Acting Asst. Prof. of Civ. Eng., Univ. of Idaho; previously with Idaho Bureau of Highways as Rodman, Levelman, Office Engr., Draftsman, Transitman, and Res. Engr.

ROWLEY, PHILO MELLS, Fort Knox, Ky. (Age 39) (Claims RC 3.1 D 2.3) Nov. 1940 to date (on leave from City of Cleveland) with Havens and Emerson, Archt.-Engr., as Designer on water-distribution system; Jan. 1938 to Nov. 1940 with Dept. of Public Utilities (Water), City of Cleveland, Ohio, as Jun. Civ. Engr. and Pitometer Operator; previously San. Engr. with CWA, Cuyahoga County, Ohio.

SCHECKEL, WILLIAM BOULTON, Cynwyd, Pa. (Age 46) (Claims RCA 10.2 RCM 5.6) May 1941 to date Structural Engr., United Engrs. & Constrs., Inc., Philadelphia; previously on Chickamauga project, as Asst. to Project Design Engr. TVA; Inventory Asst., Consolidated Gas Co.

SCHEETZ, WILLIAM CRAMP, JR., Bala-Cynwyd, Pa. (Age 30) (Claims RCA 1.8 RCM 3.4) May 1941 to date Asst. Civ. Engr., CEC, U.S. Navy, 4th Naval Dist., Philadelphia, Aug. 1936 to May 1941 with Savery, Scheetz & Gilmour, Archts., Philadelphia.

SCHLUP, TRUMAN BANKSON, Kansas City, Kans. (Age 31) (Claims RCA 3.6 RCM 2.5) April 1939 to date City Engr., Kansas City, Kans., previously with Wyandotte County, Kans., as Instrumentman, and Asst. County Engr.

SHUMAKER, LOY EUGENE, Pittsburgh, Pa. (Age 41) (Claims RCA 7.7) April 1939 to date with U.S. Engr. Dept., as Draftsman and Inspector, since May 1941 acting as Asst. to Res. Engr.; previously Draftsman with Gannett, Eastman, and Fleming, Harrisburg, Pa., and Pennsylvania Flood Control Bureau, Philadelphia; Jun. Engr., Pennsylvania Dept. of Forestry.

SIMATOVICH, ANTHONY PATRICK (Junior), San Francisco, Calif. (Age 32) (Claims RCA 3.6) April 1941 to date Asst. Structural Engr., U.S. Engr. Dept.; previously Jun. Highway Engr., U.S. Bureau of Public Roads.

SMITH, JOHN EDWARD (Junior), Chester, Pa. (Age 32) (Claims RCA 1.4) Oct. 1937 to Oct. 1938 and April 1939 to date with Stone & Webster Eng. Corporation, as Rodman, Chainman, Inspector, Field Engr. and Res. Engr.

SONNE, JULIUS ASA (Junior), Sacramento, Calif. (Age 33) (Claims RCA 1.7) Feb. 1938 to date Jun. Structural Eng. Draftsman, Div. of Archt., California Dept. of Public Works; previously with California Div. of Highways, as Structural Eng. Office Aide, Bridge Dept., and Jun. Mech. Eng. Draftsman; Structural Draftsman, U.S. Eng. Dept., San Francisco; Jun. Structural Engr., San Francisco Bay Exposition Co.

SWATEK, GEORGE FRANCIS, Lincoln, Nebr. (Age 31) (Claims RCA 3.3 RCM 2.4) March 1934 to date with Dept. of Roads and Irrigation as Inspector, Instrumentman, Asst. to Constr. Engr., Asst. Materials Engr., and (since Nov. 1939) Materials Engr.

THOMAS, MENDALL PATTERSON (Junior), Hartford, Conn. (Age 33) (Claims RCA 2.0) May 1936 to date with U.S. Geological Survey, Water Resources Branch, as Jun. Engr., PWA and (since Oct. 1936) Jun. Hydr. Engr.

TREWHITT, WAYNE DOUGLAS, JR. (Junior), Oakland, Calif. (Age 32) (Claims RCA 5.0) March 1933 to date with Easley & Brassy, as Timekeeper and Second in charge, and (since March 1934) Supt.

VAN NESS, CHARLES GEDNEY, JR., Lakewood, Ohio. (Age 34) (Claims RCA 9.0 RCM 1.0) Feb. 1941 to date Designer, Arthur G. McKee and Co., Cleveland, Ohio; previously with Mahoning County (Ohio) Engr.'s Office, as Chf. of Party, Designer, and Specification and Inspection Engr.

WHITE, ROBERT EMELIN (Junior), New York City. (Age 28) (Claims RCA 4.4 RCM 0.6) July 1934 to Sept. 1935, Feb. to April 1936 and June 1937 to date Engr., Spencer, White & Prentis, Inc.; in the interim Engr., Eng. Constr. Corporation.

WHITE, THORWALD BARTIMUS, Roswell, N.Mex. (Age 40) (Claims RCA 13.4) June 1926 to date with New Mexico State Highway Dept., as Instrumentman, Project Engr., Highway Designer, Dist. Highway Office Engr., and (since Jan. 1935) Asst. Dist. Highway Engr.

WILLARD, JAMES EDWARD, Knoxville, Tenn. (Age 44) (Claims RCA 18.8) 1926 to 1933 and 1936 to date with A. H. Whisman Co., as Engr., Estimator, Supt. of Constr., and (since 1936) Engr. and Vice-Pres.; in the interim Bldg. Inspector and Planning Engr., Planning Comm., Knoxville, Tenn.

WYATT, WENDELL CHAMBERS (Junior), Lawrence, Kans. (Age 32) (Claims RCA 3.4 RCM 0.4) Oct. 1937 to Sept. 1940 and June 1941 to date Asst. Engr., Div. of Sanitation, Kansas State Board of Health; previously Res. Engr. and Designer, Black & Veatch, Cons. Engrs., Kansas City, Mo.

APPLYING FOR JUNIOR

CAVALIERE, ALFONSO MARIA, New Haven, Conn. (Age 26) July 1938 to March 1939 and Aug. 1940 to date with State of Connecticut as Structural Draftsman, Dept. of Public Works and (since Aug. 1940) Senior Eng. Aide Draftsman, State Highway Dept.; in the interim unemployed.

COSENS, KENNETH WAYNE, East Lansing, Mich. (Age 26) (Claims RC 2.0 D 1.0) April to June 1941 and Sept. 1941 to date Instructor in Civ. Eng., Michigan State Coll.; in the interim Plat Engr., Auditor General's Dept., State of Michigan; previously Acting Asst. City Engr., Dept. of Public Works, Pontiac, Mich.

GEIGER, LAWTON DELANY, Milan, Tenn. (Age 23) June 1941 to date on active duty as Reserve Officer with U.S. Army at Wolf Creek Ordnance Plant; previously with U.S. Housing Authority, M. A. Quina, Jr., Inc., and Harvey & Quina, Gen. Contrs.

GOODWIN, JAMES FREDERICK, Ancon, Canal Zone. (Age 26) May 1939 to date with The Panama Canal, as Jun. Engr., and (at present) Asst. Engr.; previously Structural Steel Detailer, American Bridge Co.; Eng. Aide, New York State Highway Dept.

HEALY, JOHN HAMILTON, Ironwood, Mich. (Age 25) Sept. 1941 to date Structural Designer and Draftsman, Mead, Ward and Hunt, Camp McCoy, Wis.; March 1940 to June 1941 with Robert E. McKee, Gen. Contr. and Constr. Engr., as Estimator, and Constr. Engr. (Field); previously with Sutherland Paper Co., Kalamazoo, Mich.; Field Engr., Miller-Davis Co., Engrs. and Bldrs., Kalamazoo, Mich.

LLOYD, CLYDE LEONARD, JR., Houston, Tex. (Age 27) (Claims RCA 1.0) June 1941 to date Office Engr., Sheffield Steel Corporation of Texas; previously Research Asst., Washington Univ., St. Louis, Mo.

PERKINS, GERALD STEPHEN, Berkeley, Calif. (Age 26) Dec. 1938 to date with Univ. of California, Dept. of Grounds and Bldgs., Eng. Div., as Draftsman, Surveyor, and finally Const. Inspector; previously Control Chemist, American Potash and Chemical Corporation.

1941 GRADUATES

CATHOLIC UNIV. OF AMERICA

MCCARTHY, HARRY LEVINGSTON, JR. (21)
MARTINI, ARIGO JOHN PAUL (21)

UNIV. OF CIN.
(C.E.)

Nodarse, Aristides Olegario (24)

UNIV. OF COLO.
(B.S. in Arch. Eng.)

Leonard, Aubrey Glenn (23)

GA. SCHOOL TECH.
(B.S. in Civ. Eng.)

Hansell, William Albert, Jr. (23)

IOWA STATE COLL.
(B.S. in Civ. Eng.)

Fuhr, Walter Ervin (24)
Hulsbos, Cornie Leonard (21)
Yarabeck, Robert Roland (22)

UNIV. OF MO.
(B.S. in C.E)

Smith, Robert Arthur (22)

NORTHWESTERN UNIV.
(B.S. in Civ. Eng.)

Torp-Smith, Robert Emil (23)

PA. STATE COLL.
(B.S. in Arch. Eng.)

Garratt, David Lyman (22)

PURDUE UNIV.
(B.S.C.E.)

Farrell, Max Joseph (20)
Martin, William Clarence (27)
Teske, Wilmer Edwin (24)

UNIV. OF SO. CALIF.
(B.S.C.E.)

Everett, Leon Newton (25)

UNIV. OF TENN.
(B.S. in C.E.)

Burns, Robert Chester (27)

A. & M. COLL. OF TEX.
(B.S.)

Krocker, Robert Adolph (21)

UNIV. OF UTAH
B.S. in Civ. Eng.

Lofgren, Benjamin Elder (23)

UNIV. OF WASH.
(B.S. in C.E.)

Mausbeth, Floyd Elvin (22)

WORCESTER POL. INST.
(B.S. in Civ. Eng.)

D'Errico, Thomas Richard (28)

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.

Men and Positions Available

These items are from information furnished by the Engineering Societies Personnel Service, with offices in Chicago, Detroit, New York, and San Francisco. The Service is available to all members of the contributing societies. A complete statement of the procedure, the location of offices, and the fee is to be found on page 141 of the 1941 Year Book of the Society. To expedite publication, notices of positions available should be sent direct to the Personnel Service, 31 West 39th Street, New York, N.Y. Employers and applicants should address replies to the key number, care of the New York Office, unless the word Chicago, Detroit, or San Francisco follows the key number, when it should be sent to the office designated.

Construction

Graduate Civil Engineer; Assoc. M. Am. Soc. C.E.; age 35; married; 3 years reinforced concrete design and plant layout; 3 years superintendent of construction and building maintenance for large Middle West manufacturing company; at present employed in last position named above. Prefers general management of construction or operation. Location, United States. C-879.

Civil Engineer; Assoc. M. Am. Soc. C.E.; 32; married; B.S.C.E., North Dakota State; Master of C.E., Cornell University; member Sigma Xi; 4 years topographical and cadastral surveying and mapping as chief of party; 4 years varied construction, including 1 year as engineer, superintendent. Desires structural work in either design or construction. C-880.

Bridge Engineer; Assoc. M. Am. Soc. C.E.; graduate; New Jersey professional engineers' license; 33; married; now employed as county bridge engineer; 10 years' experience all phases of bridge design and construction. C-882.

Design

Civil Engineer; Jun. Am. Soc C.E.; age 24; married; master's degree, Massachusetts Institute of Technology; 3½ years design and construction of bridges, subways, and buildings; design position desired, preferably in field of bridges. Must be in Metropolitan Area. C-877.

Executive

Civil Engineer; Executive; M. Am. Soc. C.E.; age 44; married; C.E., 1922; 19 years municipal and federal public works, including care and management of water supply system; desires responsible position with private water supply company; East preferred. C-878.

Hydraulic

Civil and Hydraulic Engineer; Assoc. M. Am. Soc. C.E.; 35; married; B.S. and M.S. in C.E.; 3 years surveying and highway construction; 10 years office experience on flood control, irrigation, and water supply, covering design, cost estimates, specifications, and supervision. Location, Texas or the Southwest. C-885.

Junior

Civil Engineer; Jun. Am. Soc. C.E.; 26; married; B.S. in C.E., University of California, 1937; membership in three honorary societies; registered professional engineer, California; 4½ years' experience in construction and hydraulics—supervised maximum of 23 men. Employed by government; desires to join private organization, preferably one depending on efficiency and profit for survival. C-882.

Civil Engineer; Jun. Am. Soc. C.E.; B.S.C.E., New York University, 1934; desires work evenings and week-ends in New York City and vicinity; 7 years' experience in construction, estimating and surveying, topographic surveying and mapping, flood control and river and harbor surveys and reports. Anything. C-883.

Civil Engineer; Jun. Am. Soc. C.E.; age 28; married; B.S. degree, University of California; four years hydraulics; investigation, flood control reclamation studies. Position with private company desired; location immaterial if opportunity is adequate. C-886.

Civil Engineer; Jun. Am. Soc. C.E.; 30; married; master's degree; 3 years' miscellaneous construction and concrete experience; 5 years' detail and design experience on structural and all types of heavy plate work, riveted and welded; desires position with fabricator, consulting or contracting engineers. Southern California preferred. C-887-4110-A-1-San Francisco.

Miscellaneous

Civil Engineer; Assoc. M. Am. Soc. C.E.; 37; B.C.E. degree (evening school); 21 years' experience in water-works, design, purchasing, maintenance and operation, distribution system surveys. Includes 4 years valuation experience, making engineering investigations and appraisals of water-works projects, rate analysis; thorough knowledge of utility accounting. Now employed; desires permanent position. Salary, $3,600 per year. C-884.

Positions Available

Structural Steel Designer. Must have had experience with steel fabricators, particularly on building work. Should have gained this experience with a steel company as a designing engineer. Must also be familiar with welding and rigid frame design. Salary open. Location, South. Y-8531.

Concrete Draftsman with some design experience. Salary, $3,000 a year. Location, New York, N.Y. Y-8554.

Assistant Civil Engineer with two to three years' experience, preferably on plant construction and maintenance. Salary, $2,100–$2,400 a year. Location, New York Metropolitan Area. Y-8678.

Civil or Mechanical Engineer, not over 30, with railway or railway supply experience for general office engineering work. Permanent. Location, New York, N.Y. Y-8729.

Office Engineer, civil engineering graduate, to handle estimating, check designs, direct contractors, dictate correspondence; in general, all administrative duties. Salary open. Location, New York, N.Y. Y-8730.

Structural Designer and Draftsman experienced in wood, concrete, and steel. Salary, $3,900 a year. Location, New York, N.Y. Y-8746.

Engineer to do general office work in engineering sales department. Should be acquainted with rolled steel products and capable of making accurate shop drawings and sketches. Must have a good character, be industrious and interested in permanent position. Excellent opportunity. Location, New Jersey. Y-8795.

Recent Graduate Civil Engineer capable of handling steel construction work. Railroad experience would be advantageous. Salary, $2,700 a year. Location, New York Metropolitan Area. Y-8805.

Cost Engineers who have had experience in construction, cost keeping, and construction control on large construction projects, for the purpose of developing unit cost data for record, for study, and for control of the cost of construction operations. Will be in complete charge of the work with a personnel of eight men. Salary, $3,200–$4,600 a year. Location, United States. Y-8839.

Graduate Civil Engineers and Engineering Draftsmen for construction work on an army cantonment. Apply by letter giving experience record with previous salaries, education, and personal data, and some personal and business references. Location, South. Y-8978.

Instructor to teach and supervise courses in elementary and advanced hydraulics, theory and laboratory, water power engineering, and kindred subjects. Master's degree and some practical experience desirable. Salary will depend on qualifications with title ranging from instructor to full professor. Location, Middle West. Y-8994.

Structural Field Engineer experienced on heavy industrial structures for plant to be erected in the West. Salary, $5,600 a year. Y-9046.

Fieldmen (2) one for work in the Eastern territory, and one in central territory out of Chicago. Should be qualified to call on the architectural and construction trade, promoting the use of the association's building material and follow up on jobs which have been awarded. Should also have good acquaintance with building code revision work. Salary, $3,000 a year. Y-9052-R-328-C.

Civil Engineer, 35–45, to check designs, specifications, plans; some experience in electricity and mechanics desirable. Half construction and half design. Salary, $3,000–$3,900 a year. Location, Virginia. Y-9055.

Civil Engineer with general experience on buildings, marine work, roads, etc. Must be high-grade type and qualified to earn in the neighborhood of $6,500 a year. Location, Trinidad. Y-9069.

Draftsmen (3) experienced on topographical wqrk, surveying, etc. Salary, $3,900 a year. Location, Trinidad. Y-9070.

Construction Superintendent who has had some experience on erection of store fronts. Permanent. Salary, $2,600–$3,600 a year. Location, New York, N.Y. Y-9079.

Manager, 40–45, well-qualified to set up a rapid, accurate, workable system of keeping construction costs on a $20,000,000 defense construction project, and be responsible for all estimates, and the tapid and accurate assembling of costs and preparing cost reports. Should be a capable engineer and executive; aggressive, but able to get along well in large organization. Should also be familiar with present construction cost trends and thoroughly familiar with sources of reliable current construction-cost information. Salary, $5,200–$9,100 a year. Location, South. Y-9128.

Engineers. (*b*) Principal draftsmen (3); salary, $2,875 a year. (*c*) Associate architects; salary, $4,000 a year. (*d*) Office engineer; salary

$4,000 a year. (*e*) Construction superintendents; salary, $4,750 a year. (*f*) Chief of party; salary, $2,875 a year. Location, foreign. Y-9134.

CONSTRUCTION ENGINEERS, mechanical or civil, who have had several years' experience on industrial plant construction, power house and/or equipment installation. Also, Junior Engineer with construction layout experience. If interested, write for company application blank. Salaries, $2,400–$4,800 a year. Location, South and Middle West. Y-9146.

STRUCTURAL ENGINEER, designer and draftsman, experienced in steel and concrete for industrial and warehouse building. Permanent. Salary, $3,600–$3,900 a year. Location, New York Metropolitan Area. Y-9148.

CIVIL ENGINEER with a knowledge of outside construction, engineering, and accounting, to operate a cost-keeping system already established. Salary, $5,200 a year. Location, foreign. Y-9152.

STRUCTURAL ENGINEER AND DESIGNER with experience in reinforced concrete and steel design. Salary open. Headquarters, New York, N.Y. Y-9164.

GRADUATE ENGINEER with two to four years' experience in architectural designing and drafting. Duration, the emergency. Salary, $2,400–$3,000 a year. Location, New York, N.Y. Y-9171.

RECENT BOOKS

New books of interest to Civil Engineers donated by the publishers to the Engineering Societies Library, or to the Society's Reading Room, will be found listed here. The notes regarding the books are taken from the books themselves, and this Society is not responsible for them.

ARCHITECTURAL GRAPHIC STANDARDS FOR ARCHITECTS, ENGINEERS, DECORATORS, BUILDERS AND DRAFTSMEN, 3 ed. By C. G. Ramsey and H. R. Sleeper. John Wiley & Sons, New York; Chapman & Hall, London, 1941. 344 pp., diagrs., charts, tables, 12 × 9½ in., cloth, $6.

Standards and recommended practices in building, with many other data constantly used by architects and designers, are presented here in an unusually convenient form for quick reference. The book consists entirely of plates with a very full index. It covers a broad field, including not only building construction but also landscaping and site development, the planning of sports fields, furniture, and miscellaneous equipment for various types of buildings.

DEEP WATER, published by New York Marine News Co., New York, N.Y.; printed by Recorder Press, Plainfield, N.J., 1941. 77 pp., illus., maps, tables, 11½ × 9 in., fabrikoid, apply (not for sale).

A series of descriptive articles on the major inland waterways of the United States is presented in this volume, in an endeavor to point out the benefits to the public from the development and use of these facilities. Statistical and technical information is included, and there are numerous illustrations.

DESIGN HANDBOOK FOR PRACTICAL ENGINEERS. By A. Cibulka. Apply to author, Dr. Alois Cibulka, Baytown, Tex., 1941. Diagrs., charts, tables, 12 × 9 in., paper, $10; reduced price in lots of three or more.

The five parts of this compilation of design data and formulas cover the following fields: strength of materials; steel and concrete structures; pressure and vacuum vessels; piping and metals; hydraulics and heat transfer; mathematical tables and general engineering formulas. Most of the material is in the form of tables and charts, with such explanation as is considered necessary.

ELEMENTS OF ENGINEERING THERMODYNAMICS, 6 ed. rewritten. By J. A. Moyer, J. P. Calderwood, A. A. Potter. John Wiley & Sons, New York; Chapman & Hall, London, 1941. 217 pp., diagrs., charts, tables, 9½ × 6 in., cloth, $2.50.

In the present edition, as in the previous ones, this book is designed to stress the fundamental principles of engineering thermodynamics as a foundation for the more advanced and practical applications of the theory. It is intended, particularly, for use in technical colleges having special courses in advanced thermodynamics, steam turbines, internal combustion engines, heating, refrigeration, and other applications of thermodynamics.

ENGINEERING DESCRIPTIVE GEOMETRY AND DRAWING. By F. W. Bartlett and T. W. Johnson. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1941. 572 pp., illus., diagrs., charts, tables, 572 pp., cloth, $4.50.

This comprehensive textbook, developed for use at the U.S. Naval Academy, consists of the following three parts: (1) Line drawing, which is chiefly concerned with the manner of handling the instruments; (2) engineering descriptive geometry, which deals with the rules of orthographic projection applied to simple geometrical shapes; and (3) engineering drawing, which describes the application of the general principles of drawing to engineering purposes with emphasis on detail drawing.

ENGINEERING ENCYCLOPEDIA, 2 Vols. Edited by F. D. Jones. Industrial Press, New York, 1941. 1431 pp., diagrs., charts, tables, 9½ × 6 in., fabrikoid, $8.

This two-volume reference work supplies such practical and useful information as the various important mechanical laws, rules, and principles; physical properties and compositions of a large variety of materials used in engineering practice; and the characteristic features and functions of different types of machine tools and other equipment. The 4,500 topics included are alphabetically arranged and cross-indexed for convenient reference, and have been selected for their usefulness in the mechanical industries.

(The) ENGINEERING PROFESSION. By T. J. Hoover and J. C. L. Fish. Stanford University Press, Stanford, Calif.; Humphrey Milford and Oxford University Press, London, 1941. 441 pp., diagrs., charts, maps, tables, 9½ × 6 in., cloth, $5.

This book describes the qualifications and duties of the professional engineer and his habit of mind, and indicates the rewards that an engineering career has to offer to qualified men. It presents an extended analysis of the sphere and status of the profession and points out its capacities for future development. The study will be especially valuable to young men contemplating a career in engineering and to instructors, because of the light it throws on the engineering method and its relation to school work, but should also prove of interest to the practical engineer.

Great Britain, Ministry of Transport. EXPERIMENTAL WORK ON ROADS, Report for 1938–1939 of the Experimental Work on Highways (Technical) Committee. His Majesty's Stationery Office, London, 1939. 179 pp., tables, 9½ × 6 in., paper. (Obtainable from British Library of Information, 620 Fifth Ave., New York, 75 cents.)

Beginning about the year 1929, the Ministry of Transport has built a number of experimental roads in Great Britain, in order to study the behavior of various types of construction. The present report covers the condition of these roads after an added year of use, and gives interim conclusions as to their suitability. Roads of concrete and cement-bound macadam, roads with bituminous surfacings and with thin surfacing coats are described. Surface dressings, rural footpaths, and bicycle tracks are also considered.

INTRODUCTION TO GEOLOGY, 2 ed. By E. B. Branson and W. A. Tarr. McGraw-Hill Book Co., New York and London, 1941. 482 pp., illus., diagrs., charts, maps, tables, 9 × 6 in., cloth, $3.75.

Intended as a general text for students not majoring in geology as well as for those who are, this book avoids technicalities in presenting the outstanding principles of the subject. The fundamentals of both physical and historical geology are covered. Over four hundred photographs, maps, and diagrams aid the beginning student in understanding the text.

MATHEMATICAL TABLES. By H. B. Dwight. McGraw-Hill Book Co., New York, 1941. 231 pp., tables, 9½ × 6 in., cloth, $2.50.

The values of both natural functions and logarithms of trigonometric functions are given to four or five places of decimals in hundredths of degrees rather than minutes and seconds. Exponential, hyperbolic, and other commonly used functions are also included. Tabular differences are included wherever desirable.

MATHEMATICS (The Pennsylvania State College Industrial Series), by J. W. Breneman. 210 pp., $1.75; MECHANICS (The Pennsylvania State College Industrial Series), by J. W. Breneman. 141 pp., $1.50; STRENGTH OF MATERIALS (The Pennsylvania State College Industrial Series), by J. W. Breneman. 145 pp., $1.50; and BLUE PRINT READING AND SKETCHING (The Pennsylvania State College Industrial Series), by H. R. Thayer. 141 pp., $2. McGraw-Hill Book Co., New York, 1941. Illus., diagrs., charts, tables, 9½ × 6 in., cloth.

The texts included in this new series are designed to give simplified presentations of the fundamentals of their respective subjects. Intended for the student or apprentice with limited mathematical background, the theoretical treatment is held to a minimum. Stress is laid on the application of principles of these subjects to important practical problems that are common in industry. Further volumes on engineering drawing, machine design, electricity, etc., are to be included in the series.

MODERN METALLURGY FOR ENGINEERS. By F. T. Sisco. Pitman Publishing Corp., New York and Chicago, 1941. 426 pp., illus., diagrs., charts, tables, 9½ × 6 in., cloth, $4.50.

This concise study of recent developments in ferrous and non-ferrous metallurgy provides essential data on the engineering properties of metallic materials, the variables affecting these properties, and their significance to engineers. The relation between constitution and structure of materials and properties is briefly shown in an elementary discussion of fundamental modern concepts of physical metallurgy. Review questions and a bibliography are appended.

PHOTOELASTICITY, Vol. 1. By M. M. Frocht. John Wiley & Sons, New York; Chapman & Hall, London, 1941. 411 pp., illus., diagrs., charts, tables, 9½ × 6 in., cloth, $6.

The two-volume work, of which this text is Vol. I, contains the essential material for a thorough understanding of the theoretical principles and experimental procedures for the exploration of all two-dimentional stress systems by the method of photoelasticity. This volume is confined to the strictly photoelastic methods for plane stress analysis, which are based entirely on the stress pattern and the isoclinics.

Ref

REINFORCED CONCRETE CHIMNEYS. By C. P. Taylor and L. Turner. Concrete Publications, Ltd., London, 1940. 64 pp., illus., diagrs., charts, maps, tables, 9½ × 6 in., cardboard, $3.50 (obtainable from the Engineers Book Shop, 168 East 46th St., New York).

This practical manual deals with the design of reinforced concrete chimneys in accordance with modern British practice. Standard types are described, design data are given for all important factors, and there is a chapter dealing with flue openings, linings, bands, and other specific features. Special attention is paid to the scientific calculation of the stresses caused by hot gases.

SPECIFICATION DOCUMENTS FOR BUILDING MATERIALS AND CONSTRUCTION, 1941 ed. Pacific Coast Building Officials Conference, 124 West Fourth St., Los Angeles, Calif. 400 pp., illus., diagrs., charts, tables, 8 × 5 in., cloth, $5.

Sixty-two standard and tentative specifications and test programs, to which reference is made in the Uniform Building Code of the Pacific Coast Building Officials Conference, are combined in this volume. The material is classified and arranged for ready reference. Like the previous editions, this comprehensive collection of structural standards should prove a great convenience to structural engineers, architects, and specification writers.

STRENGTH OF MATERIALS, Pt. 2. Advanced Theory and Problems, 2 ed. By S. Timoshenko. D. Van Nostrand Co., New York, 1941. 510 pp., illus., diagrs., charts, tables, 9 × 6 in., cloth, $4.50.

This standard textbook for advanced students, research engineers, and designers has been revised after a period of eleven years. The material, both theoretical and experimental, which has been added, represents recent developments in the fields of stress analysis and experimental investigation of mechanical properties of structural materials. For the most part these additions are applicable to current problems such as airplane construction.

TABLE OF NATURAL LOGARITHMS, Vol. 1. Logarithms of the Integers from 1 to 50,000; prepared by the Federal Works Agency, Work Projects Administration for the City of New York; conducted under the sponsorship of and for sale by the National Bureau of Standards, Washington, D.C., 1941. 501 pp., tables, 11 × 8 in., cloth, $2 (payable in advance).

Continuing the series of mathematical tables being compiled by the Work Projects Administration, this book constitutes Vol. 1 of a projected four-volume table of natural logarithms. The natural logarithms are given here to sixteen decimal places for the integers from 1 to 50,000. Succeeding volumes will carry to 100,000 and cover the range from 0 to 10 at intervals of 0.0001.

TEXTBOOK OF SOUND, 2 rev. ed. By A. B. Wood. Macmillan Co., New York, 1941. 578 pp., illus., diagrs., charts, tables, 9 × 5½ in., cloth, $6.50.

Subtitled "an account of the physics of vibrations with special reference to recent theoretical and technical developments," this text treats of vibrations of all frequencies, audible or otherwise. Vibrating systems and sources of sound are thoroughly covered, following a section on vibration theory. Sound transmission and the reception, transformation, and measurement of sound energy are discussed. The final section deals with various important technical applications.

TRANE AIR CONDITIONING MANUAL, published by The Trane Company, La Crosse, Wis., 1941, revised ed. 376 pp., illus., diagrs., charts, maps, tables, 11½ × 8½ in., cloth, $5.

Primarily concerned with the application of the fundamental facts of engineering to the design of air conditioning systems, this publication touches on all phases of the field. Heat and its transmission, physical comfort, air properties and supply, psychrometry, refrigeration and ventilation processes, the functions of water in air conditioning, and a chapter on ducts and fans, new in this edition, are all covered in this comprehensive treatment of the subject. Diagrams, tables, problems, and numerical examples add to its practical value.

CURRENT PERIODICAL LITERATURE

Abstracts of Articles on Civil Engineering Subjects from Publications (Except Those of the American Society of Civil Engineers) in This Country and Foreign Lands

Selected items for the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file in The Engineering Societies Library, one of the leading technical libraries of the world. Some 2,000 technical publications from 40 countries in 20 languages are received by the Library and are read, abstracted, and indexed by trained engineers. With the information given in the items which follow, you may obtain the article from your own file, from your local library, or direct from the publisher. Photoprints will be supplied by this library at the cost of reproduction, 25 cents per page to members of the Founder Societies (30 cents to all others), plus postage, or technical translations of the complete text may be obtained at cost.

DAMS

TRASH RACKS. Tapered Trash Rack Bars, P. Baumann. *Eng. News-Rec.*, vol. 127, no. 3, July 17, 1941, p. 115. Features of new design of trash racks for San Gabriel Dam No. 2 of Los Angeles County Flood Control District, in which clearance between each pair of bars increases in direction of flow.

FLOOD CONTROL

CONNECTICUT RIVER. Flood Control on Connecticut. *Eng. News-Rec.*, vol. 127, no. 3, July 17, 1941, pp. 82–86. Review of current plans for flood control in Connecticut River basin; location of reservoirs and local protection work; methods used in selecting reservoir sites; balancing reservoir costs against cost of protective works along river and determining economic benefits of protection afforded; power and conservation.

FOUNDATIONS

PILES, CONCRETE. Reinforced Concrete Piles in Foundations, P. G. O'Rourke. *Inst. Civ. Engrs. Ireland—Trans.*, vol. 66, 1939–1940, pp. 41–67 and (discussion) 69–79. Review of use of reinforced concrete piles in foundations, with special reference to cast-in-situ driven piles, bored piles, and pre-cast concrete piles; tests of site; selection of size of pile; determination of set; head stresses on piles; selection of hammer and calculation of set; Hiley's pile-driving formula.

SAND. Hoechstbelastete Fundamente auf Sandboden, H. Seeger. *Deutsche Bauzeitung*, vol. 75, no. 13, Mar. 26, 1941, pp. 231–237. Review of modern methods of building foundations on sandy ground with use of piles, or sheet-piling, caissons, chemical consolidations, etc.

SUBWAY CONSTRUCTION, CHICAGO. Measurement of Earth Pressures on Chicago Subway, R. B. Peck. *Am. Soc. Testing Matls.—Bul. No. 111*, Aug. 1941, pp. 25–30. Methods used to determine earth pressure acting in existing open cuts, and coincident soil movements; techniques presented are given in hope that men associated with construction of open cuts will be impressed with comparative simplicity of determination of earth pressures, and will be led to make measurements of their own in order to add to common fund of engineering knowledge.

HYDROLOGY AND METEOROLOGY

RAILROAD BUILDINGS, EARTHQUAKE RESISTANCE. Earthquake Reconstruction on Quetta (Railway) Division 1936–1940, R. O. C. Thomson. *India Railway Board—Tech. Paper No. 307*, 1940, 64 pp., supp. plates, Price Re 1-8-0 or 1s. 3d. Report on anti-earthquake designs for various buildings of East Indian Railway following earthquake of May 31, 1935; seismic factor and development of designs; unframed buildings of "banded" type; structural framed buildings; design of earthquake-proof buildings; design data adopted by G. C. Trehan for earthquake-resisting buildings on Quetta Division with subsequent modifications.

RUNOFF, HYDROGRAPH. Unit Hydrograph and Its Application, L. K. Sherman. *Associated State Eng. Soc.—Bul.* vol. 17, no. 2, Apr. 1941, pp. 4–22. Review of developments in methodology for estimating runoff from rainfall; examples illustrating some of approved procedures now in general practice; infiltration and derivation of net rainfall; 24-hour unit hydrographs; computation of net rain by infiltration theory; 12 and 6-hour unit hydrographs; derivation of unit hydrographs from compound hydrograph; selection of unit time. Bibliography.

SILT, TRANSPORTATION. Transportation of Sediment by Flowing Water and Its Importance in Soil Conservation, J. W. Johnson. U.S. Soil Conservation Service—*Soil Conservation*, vol. 6, no. 11, May 1941, pp. 290–293. Study of silt transportation by flowing water, with special reference to observations made at sediment-load laboratory near Greenville, S.C.; density currents in reservoir; vertical distribution of suspended sediment in Lake Issaqueena.

SOILS, EROSION. Soil Erosion, E. S. Clayton. *Australian Surveyor*, vol. 8, no. 5, Mar. 1, 1941, pp. 260–264. Director of Soil Erosion Services of New South Wales discusses nature of soil erosion and its effect on stream flow; unsatisfactory stream flow in Australian rivers; land slips; value of dense pasture.

WATERSHEDS, EVAPORATION. Natural Water Loss in Selected Drainage Basins, G. R. Williams. *U.S. Geol. Survey—Water Supply Paper 846*, 1940, 59 pp. 15 cents. Statistical study presenting results of computations of annual water loss or annual rainfall minus annual runoff, for river basins in humid or semi-arid regions east of Rocky Mountains; sample computations; probable accuracy of results; results are given for about 200 drainage areas with aggregate period of record of more than 2,000 years; relation between water loss and temperature.

IRRIGATION

CANALS, DESIGN. Economics of Deccan Canals—Selection of Water Depth, N. S. Joshi. *Instn. Engrs. India—J.*, vol. 20, Jan. 1941, pp. 198–229 and (discussion) 237–244, supp. plates. Discussion of principles of design of irrigation canal in comparatively non-erodible soils of Deccan, Bombay, and other regions of India, with special reference to selection of suitable water depths.

INDIA. Annual Report (Technical) of Central Board of Irrigation, India, 1938–1939. *India Central Board Irrigation—Publ. No. 22*, Jan. 10, 1940, 185 pp., figs., tables, diagrs., supp. plates. Report on research in irrigation engineering: Design of canal falls; meandering of rivers; silting of reservoirs; silt excluders and ejectors; torrents in boulder rivers and streams; role of reservoirs in flood control; water-logging and land reclamation; design of drains in irrigated areas; design of channels in alluvium; soil denudation.

MEXICO. La Obra de la Comision Nacional de Irrigacion, Mexico, D. F., *Estados Unidos Mexicanos*, 1940, 275 pp., supp. plates, maps. Work of National Irrigation Commission during administration of President Lazaro Cardenas, 1934 to 1940; general descriptive and statistical review.

PUMPING PLANTS, TEXAS. Pumping Plants for Irrigation System. *Eng. News-Rec.*, vol. 127, no. 1, July 3, 1941, pp. 21–23. Description of new irrigation pumping plant of Willacy County Water Control and Improvement District No. 1 in Rio Grande Valley in Texas, including four 48-in. and three 42-in. Diesel-driven pumps; features of re-lift plants and portable pumping units; plan of river pumping plant; distribution network; portable units for sprinkling.

LAND RECLAMATION AND DRAINAGE

BRAZIL. Condicoes em que se encontram os principais portos Maritimos, Fluviais e Lacustres do Pais, L. R. Cavalcanti de Albuquerque, Jr. *Clube de Engenharia Rio de Janeiro*, vol. 6, no. 69, Sept.–Oct. 1940, pp. 22–26. Conditions found in principal maritime, river, and lake ports in Brazil; classification of ports; summarized data and information on each of principal organized and unorganized ports.

DRYDOCKS, ENTRANCES. Sliding Caissons for Dock Entrances, S. C. Bailey. *Dock & Harbour Authority*, vol. 21, no. 246, Apr. 1941, pp. 129–133. Principles of design, construction, and operation of sliding caissons for temporarily closing entrances of docks and locks; dead weights of sliding caissons; stability of caissons when being floated into or out of entrance.

DRYDOCKS, NEW YORK. Proposed Large Dry Dock at Port of New York. *Dock & Harbour Authority*, vol. 21, nos. 244 and 245, Feb. 1941, pp. 73–78, and Mar., pp. 110–112. Extract of report by Port of New York Authority on need and desirability of "super docks" to accommodate ships 1,200 ft long; features of proposed design, construction methods, and equipment; estimated cost $10,000,000 to $12,000,000.

LONDON, ENGLAND. Yantlet Dredged Channel in Thames Estuary, E. C. Shankland. *Dock & Harbour Authority*, vol. 21, nos. 246 and 247, Apr. 1941, pp. 117–122, and May, pp. 145–148. Study of hydrography, tidal, and dredging research covering more difficult improvements, mainly between 1922 and 1938, in Yantlet Channel area, at seaward limit of Port of London, England; study of model of river and estuary from Teddington to Nore Lightship; charts, soundings, contouring, etc.; surface and ground currents; tidal predictions and calculations; dredging plant; marking and navigational directions.

SHORE PROTECTION, GERMANY. Landbewegungen an der deutschen Nordseekueste, S. Clodius. *Gas- u. Wasserfach*, vol. 83, no. 45, Nov. 9, 1940, pp. 562–567. Description of formations along North Sea coast of Germany and methods used for their protection. Bibliography.

WOOD PRESERVATION. Advantages of Wolmanized Lumber at Ports and Terminals Used in Superstructures, F. W. Gottschalk. *World Ports*, vol. 3, no. 11, Aug. 1941, pp. 12–13 and 18. Examination of characteristics of "salt" wood preservative; clean preservative, Wolman Salts, is discussed as exemplary of several good salt treatments in extensive use; reference made to tabulated report covering investigation of service records made by commercial installations of Wolmanized Lumber, to be published in Proceedings of 41st annual meeting of American Wood-Preservers' Assn.

ROADS AND STREETS

ACCIDENT PREVENTION. "Bounce" Kails, H. T. Moore. *Steel*, vol. 109, no. 8, Aug. 25, 1941, pp. 52–53. Description of guard rail that provides exceptional protection along edge of highways and also as road center divider; rail is held in front of posts by heavy heat-treated springs bolted at lower end to posts just above ground; comparatively light shocks are absorbed completely by spring suspending rail, while heavier shocks are absorbed by rail itself; fabrication of rails described.

ASPHALT. Direct Method of Determining Thickness of Asphalt Pavement with Reference to Subgrade Support, P. Hubbard and F. C. Field. *Asphalt Inst.—Research Series No. 7*, Apr. 1, 1941, 12 pp. Discussion of methods of determining thickness of asphalt pavements resting on plastic soils, based upon actual tests and observation of behavior of asphalt pavements resting directly upon soil masses; evaluation of load-supporting capacity of soil with reference to asphalt pavement and to its subgrade support; factors of safety; future possibilities of method.

CAMPS, MILITARY, OREGON. Fighting Time and Mud—at Portland Airport, H. W. Young. *Pac. Bldr. & Engr.*, vol. 47, no. 3, Mar. 1941, pp. 28–31. Methods and equipment used in construction of cantonment of Portland Columbia Airport near Portland, Ore., for housing 2,500 air corps troops; construction of drainage works; use of portable roadways for passage of heavier trucks.

DUST CONTROL. Some Experiments in Dust Proofing of Roads and Their Lesson, D. Hosain. *Instn. Engrs. India—J.*, vol. 21, no. 1, Apr. 1941, pp. 105–122, supp. plates. Review of experience of Public Works Department of State of Hyderabad, India, with treatments and materials for prevention of dust on dirt and metaled roads; cost data.

EMBANKMENTS. Hydraulic Fills, E. A. Collier. *Pac. Bldr. & Engr.*, vol. 47, no. 3, Mar. 1941, pp. 31–34. Construction of hydraulic-fill embankments for Columbia River Highway in Oregon by pumping dredged material as far as 7,000 ft with lifts up to 60 ft; getting power to dredge.

EROSION. Controlling Highway Erosion in Idaho, F. B. Harper. *Pac. Bldr. & Engr.*, vol. 47, no. 7, July 1941, pp. 58, 60, and 62. De-

scription of technique used to reduce maintenance on highways in Panhandle of Idaho by control of highway erosion, sodding, and wattles; grasses and trees; specifications.

FLIGHT STRIPS. Service of Flight Strips to Cities and Local Areas, T. R. Kendall. *Am. City*, vol. 56, no. 7, July 1941, pp. 37–39. Elementary discussion of principles of installation of flight strips adjacent to state highways as aids to military and commercial aviation.

HIGHWAY SYSTEMS, BRAZIL. Rede Rodoviaria do Nordeste, L. Vieira, *Clube de Engenharia Rio de Janeiro—Revista*, vol. 6, no. 69, Sept.–Oct. 1940, 28–37, supp. plates. Northeastern highway network; present status; description of highways and their principal characteristics; what highway network was and what it should be in this region.

HIGHWAY SYSTEMS, BRAZIL. Estradas de Rodagem no Estado do Rio de Janeiro, F. S. Braga. *Clube de Engenharia Rio de Janeiro—Revista*, vol. 6, no. 69, Sept.–Oct. 1940, pp. 38–43, supp. plate and map. Highways in State of Rio de Janeiro, Brazil; physical aspect; highway network in coastal lowlands of Fluminense; highway planning; highway autonomy.

HIGHWAY TRAFFIC SIGNS, SIGNALS AND MARKINGS. Marking Highway Lanes with Stone Chips. *Eng. News-Rec.*, vol. 127, no. 1, July 3, 1941, pp. 27–28. Report on experimental application of stripes of contrasting stone chips in lane marking on highways in Texas and South Dakota; outfit for applying raised center stripe pulling roller that compacts chips into ribbon $^1/_4$ in. thick at about 4 mph.

PANAMA. Work Pushed on New Highway Across Isthmus of Panama. *Eng. News-Rec.*, vol. 127, no. 3, July 17, 1941, pp. 96–98. Report on current construction of $24^1/_2$ miles of highway through tropical jungles of Panama to connect Colon with present highway from Panama City to Madden Dam, undertaken as part of work of improving defense facilities at Panama Canal; road is to be divided lane highway paved with concrete and designed to carry modern military equipment; construction operations.

STABILIZATION. Classifications of Stabilization and Elements of Expense in Typical Asphalt Stabilization Project, W. R. Macatee. *Asphalt Inst.—Information Series No. 42*, May 1, 1941, 11 pp. Classification of road stabilization processes; analysis of elements of expense involved in constructing roads stabilized with asphalt.

STABILIZATION. How Oregon Builds Cement Stabilized Base, R. A. Furrow. *Pac. Bldr. & Engr.*, vol. 47, no. 1, Jan. 1941, p. 29. Specifications for and method of construction of 1.11 miles of cement-stabilized base with 2-in. bituminous macadam wearing surface, under contract awarded by Oregon State Highway Commission on Santiam Highway east of Albany, at cost of $18,000.

STABILIZATION. Montana's First Major Sand-Soil Stabilization, D. L. Choney. *Pac. Bldr. & Engr.*, vol. 47, no. 4, Apr. 1941, pp. 32–34. Methods and equipment used for stabilizing experimental section in Garfield and Petroleum counties in Montana, $9^1/_2$ miles in length, utilizing native "blow-sand" combined with earth material in place, on roadway.

TESTING. Study of Bituminous Mixtures on Road-Testing Machines, C. Mack. *Soc. Chem. Industry—J.* (Trans. & Communications), vol. 60, no. 5, May 1941, pp. 111–120. Problem of adhesion of bitumen to mineral aggregate, and simple methods for its estimation are outlined; it is shown that adhesion of bitumens can be improved by addition of certain agents; use of road-testing machines affords practical means of studying problem of adhesion and other factors, such as temperature and traffic, which influence stability of bituminous pavements.

SEWERAGE AND SEWAGE DISPOSAL

CURRENT TREATMENT. Current Developments and Trends in Sewage Treatment, A. J. Fischer. *Sewage Works J.*, vol. 13, no. 4, July 1941, pp. 694–707 and (discussion) 707–709. Review of improvements of sewage treatment equipment and processes that have been introduced during past decade; screening; grit removal; grease removal; clarification; raw sewage flocculation; chemical treatment; aeration; trickling filters and high-rate filtration; effluent filters; sludge digestion; sludge dewatering; sludge drying and incineration.

DISPOSAL PLANTS, TRACTORS. Tank-Tractors for Sewage Sludge. *Engineer*, vol. 171, no. 4447, Apr. 4, 1941, p. 232. Illustrated description of innovation introduced at municipal plant at Springfield, Ill., to replace original plan of using trucks traveling on runways or wheelways consisting of heavy oak planks; crawler type of tractor is fitted with side tanks or bins.

DISPOSAL PLANTS, WISCONSIN RAPIDS, WIS. Primary Sewage Treatment at Wisconsin Rapids, Wis., J. W. Townsend. *Am. City*, vol. 56, no. 8, Aug. 1941, pp. 65, 67, 69, and 73. Description of improvements in sewage disposal plant of Wisconsin Rapids, Wis., having population of about 12,000; features of new intercepting sewers delivering sewage to plant; sludge digestion, filtering, and incineration; character of sewage.

INDUSTRIAL WASTES. Developments in Cannery Waste Studies at Palo Alto, J. H. Kimball and H. L. May. *Sewage Works J.*, vol. 13, no. 4, July 1941, pp. 731–741. Study of problems created by addition of cannery wastes at rate of approximately one million gallons per day to domestic sewage of Palo Alto, Calif.; strength of cannery wastes; chlorine requirements of domestic sewage with cannery waste; chemical experiments on sewage containing cannery waste; effects of chlorine and lime.

IRRIGATION. Abwasserverwertung und Grundstuecksgroesse in Siedlungen, F. Reinhold. *Gesundheits-Ingenieur*, vol. 63, no. 49, Dec. 7, 1940, pp. 633–635. Principles of utilization of sewage for watering of house gardens; German data on increase of yield due to such watering.

NEW YORK. Achievements in Sewage Treatment in New York State During Past Decade, E. Devendorf. *Sewage Works J.*, vol. 13, no. 4, July 1941, pp. 710–719. Review of achievements in sewage treatment construction in New York State during past decade, which have been almost exclusively undertaken with federal aid; PWA sewer and sewage treatment plant construction in New York State, 1934–1940, inclusive; storm and sanitary sewers and sewage treatment projects constructed under TERA program, 1933–1934.

SANITARY ENGINEERING, ARGENTINA. Obras de Saneamiento de la Ciudad de Villa Maria, F. A. Laguardia and L. C. Pilatti. *Boletin de Obras Sanitarias de la Nacion*, vol. 5, no. 43, Jan. 1941, pp. 2–10. Sanitation works of City of Villa Maria, in Province of Cordoba, Argentina; population more than 25,000; water supply from semi-artesian wells, about 100 m deep; water analysis; Diesel electric power plant, generated 456,096 kw hr in 1940; deep well centrifugal pumps, driven by direct-coupled 18-kw motors at 1,450 rpm; chlorination; distribution; sewers; sewage disposal plant.

SEWAGE DISPOSAL. Sewage Purification and Prevention of Rivers' Pollution, S. H. Jenkins. *Soc. Chem. Industry—J.* (Chem. & Industry), vol. 60, no. 19, May 10, 1941, pp. 357–362. Older methods of sewage treatment; sewerage of towns; methods in use at sewage disposal works; trade wastes; standards of purity; control of river pollution.

SEWAGE TANKS. Beitrag zur Klarstellung der Vorgaenge in Absetzbecken mechanischer Klaeranlagen, W. Kunze. *Gesundheits-Ingenieur*, vol. 63, no. 51, Dec. 21, 1940, pp. 654–656. Theoretical mathematical discussion of processes occurring in settling tanks of mechanical sewage disposal plants.

SEWAGE TANKS. Bemerkenswerte Betriebserfahrungen in einer mechanischen Absetzanlage, W. Husmann. *Gesundheits-Ingenieur*, vol. 63, no. 52, Dec. 28, 1940, pp. 669–673. Revamping of settling tanks of sewage disposal plant of Zurich, Switzerland, involving installation of scraper to improve removal of sludge and other operating conditions.

SEWAGE TANKS, OPERATION. Experiences in Digestion Tank Scum Control. *Sewage Works J.*, vol. 13, no. 4, July 1941, pp. 787–798. Compilation of experience in digester scum control in 13 plants in United States and Canada; scum control in fixed-cover digesters; scum control in floating-cover digesters; scum control for Imhoff tanks.

SEWERS, VITRIFIED CLAY. Die Baulaenge der Steinzeugrohre, O. Hett. *Gesundheits-Ingenieur*, vol. 63, no. 47, Nov. 23, 1940, pp. 610–611. Discussion of proposed increase in standard length of vitrified clay sewer pipe from 1 to 1.5 meters.

WATER POLLUTION. Industrial Stream Pollution Problems and Their Solution, R. D. Hoak. *Chem. Industries*, vol. 49, no. 2, pt. 1, Aug. 1941, pp. 170–176. Study of stream pollution-abatement problem which gives idea of what has been, and can be, accomplished wherever needed; stream utility; sources of pollution; municipal sewage; mining wastes; industrial wastes; effects of pollution; standards of stream cleanliness; cooperative interstate agreements; variety of waste treatment processes; cost of pollution abatement. Bibliography.

WILMINGTON, N.C. Water Treatment at Wilmington, N.C., N. N. Wolpert. *Water Works Eng.*, vol. 94, no. 14, July 2, 1941, pp. 824–825 and 849. Account of operating routine at water treatment plant of Wilmington, N.C.; analysis of raw water; cost of purification; details of wash figures; efficiency of bacterial removal.

STRUCTURAL ENGINEERING

BEAMS, CONCRETE. Abaques pour le calcul des poutres en beton arme flechies, G. Feytmans. *Annales des Travaux Publics de Belgique*, vol. 41, no. 5, Oct. 1940, pp. 713–726. Mathematical discussion of construction of alinement charts for design of reinforced concrete beams subjected to bending; numerical examples. (In French and Flemish.)

BEAMS, WOODEN. Der vollwandige Holztraeger aus Brettern, Bohlen und Naegeln, F. Geiger. *Deutsche Bauzeitung*, vol. 75, nos. 8 and 10, Feb. 19, 1941, pp. 112–116 and Mar. 5, pp. 173–177. Design and construction of built-up wooden beams consisting of nailed-together boards and planks; results of tests.

HOUSES, DESIGN. Modular Design. *Arch. Forum*, vol. 75, no. 1, July 1941, pp. 31–34. Discussion of principles and practice of modular design of houses permitting coordination of brick, concrete block, and cast stone with wood framing, sheet materials, and stock wood windows on uniform 4-in. basis, so that stud spacing and joints in sheet materials bear planned relationship to openings.

TUNNELS

COLORADO. Investigations, Design, and Starting of Construction, Continental Divide Tunnel, F. J. Thomas. *Reclamation Era*, vol. 31, no. 3, Mar. 1941, pp. 62–65. Description of 13-mile long Continental Divide tunnel of Colorado-Big Thompson project, Colorado; tunnel line investigations; concrete aggregate investigations; design and specification.

MINES AND MINING. Carlton Tunnel Completed in Record Time, R. Fleming. *Min. J.* (Phoenix, Ariz.), vol. 25, no. 5, July 30, 1941, pp. 3 and 4. Drainage tunnel constructed and financed by Golden Cycle Corporation of Colorado Springs, Colo., is being completed two years ahead of schedule; it is third tunnel to be driven exclusively for drainage purposes in Cripple Creek district and will unwater gold mines 1,140 ft below level of old Roosevelt Tunnel, opening up area of 30 sq miles for mining operations.

SHAFT SINKING. Shaft Sinking and Tunneling, R. S. Lewis. *Eng. & Min. J.*, vol. 142, no. 8, pt. 1, Aug. 1941, p. 106. Underground excavations in hard rock date from at least as early as 1500 B.C.; greatest ancient tunnel—19 ft high, 9 ft wide and 3 miles long—was completed in 52 A.D.; development of methods for shaft sinking in wet ground; features of modern equipment and practice; future trends.

WATER RESOURCES

UNDERGROUND, ARIZONA. Ground-Water Supply of Eloy District in Pinal County, Arizona, G. E. P. Smith. *Ariz. Univ.—Agric. Experiment Station—Tech. Bul. No. 87*, June 1, 1940, 42 pp., supp. plate. Quantitative study of source of great quantities of water pumped from wells in Eloy irrigated area; rainfall and stream flow; wells and pumping plants; crop surveys; residual lowering of water table and volume of ground unwatered; validity of method of estimating changes in stored water.

UNDERGROUND, TEXAS. Geology and Ground-Water Resources of Lufkin Area, Texas, W. N. White, A. N. Sayre, and J. F. Heuser. *U. S. Geol. Survey—Water-Supply Paper 849-A*, 1941, 58 pp., 30 cents. Study of geology and underground water resources of Angelina County, Texas, and parts of Nacogdoches and other adjacent counties; quality of water; rock formations and their water-bearing properties; character of water-bearing materials; water analyses; well logs and well records.

WATER TREATMENT

DECOLORIZATION. Results in Treating Colored and Highly Corrosive Water, R. H. Corey. *Water Works Eng.*, vol. 94, no. 18, Aug. 27, 1941, pp. 1064–1065. Review of 15-year record of Marshfield-North Bend, Ore., water filtration plant with decolorization treatment of water deeply colored with dead vegetation products; use of spray nozzles for aeration; study of lime needs.

DRINKING WATER, FLUORINE CONTENT. Removal of Fluorides from Public Water Supplies, R. C. Goodwin and J. B. Litton. *Indus. & Eng. Chem.*, vol. 33, no. 8, Aug. 1941, pp. 1046–1048. Efficiency of commercial pilot plant in removal of fluorides from natural waters containing 5 ppm determined; pilot plant was charged with 1.3 cu ft of phosphate with rated capacity of 358 grains of fluorine; 50 runs made with flow rate of 1.5 gal per min; in each case, run was continued until fluoride content reached 1 ppm; results. Bibliography. Before Am. Chem. Soc.

FILTRATION PLANTS, INDIANAPOLIS, IND. Methods of Handling Sand and Gravel, M. P. Crabill. *Am. Water Works Assn.—J.*, vol. 33, no. 7, July 1941, pp. 1221–1232. Review of operation of Indianapolis Filter Plant consisting of 36-mgd slow sand unit and 15-mgd rapid sand unit, with special reference to handling of sand and gravel; design of ejector; design of separator; rapid sand filter wash; gravel wash and regrading; mud ball formation; application of surface wash; prevention of algae troubles.

FILTRATION PLANTS, OPERATION. Results Secured at New Filter Plant, N. N. Wolpert. *Water Works Eng.*, vol. 94, no. 17, Aug. 13, 1941, pp. 984–987. Operation routine of water filtration plant of Raleigh, N.C., including statistical data on quantities of water treated and chemicals used; cost of chemicals.

GERMANY. Druckfilter einer Enteisenungsanlage aus Eisenbeton, H. Hugelmann. *Gas- u. Wasserfach*, vol. 84, no. 4, Jan. 25, 1941, pp. 57–60. Design, construction, and operation of reinforced concrete deferrization installation for German water treatment plant, including pressure filter operating at one atmosphere; cost data, showing relative economy of reinforced concrete construction.

MINNEAPOLIS, MINN. Double Cone Precipitators Soften Water at Minneapolis, J. A. Jensen. *Eng. News-Rec.*, vol. 127, no. 11, Sept. 11, 1941, pp. 372–374. Description of new Minneapolis lime treatment water-softening plant, which incorporates use of 12 double-cone precipitators, each with capacity of 10 mgd; soap savings; precipitator details.

TASTE AND ODOR REMOVAL. Correcting Tastes Caused by Dead End Mains. *Water Works Eng.*, vol. 94, no. 18, Aug. 27, 1941, pp. 1066 and 1069–1070. Practical discussion by water works superintendents of methods of removal of water tastes reported at dead ends in distribution system; method of flushing out main to correct such condition.

WATER BACTERIOLOGY. Should Larger Portions of Water Be Tested for Coliform Bacteria? R. E. Noble. *Am. Water Works Assn.—J.*, vol. 33, no. 7, July 1941, pp. 1242–1248. Report on exploratory experiments by Chicago Health Department for determining desirability of testing water for coliform bacteria with samples of 10 cc, 50 cc, and 100 cc. Bibliography.

WATER SOFTENING, ST. PAUL, MINN. St. Paul Softens Water Cheaply, R. A. Thuma. *Eng. News-Rec.*, vol. 127, no. 7, Aug. 14, 1941, pp. 228–230. Report on operation of new softening plant of St. Paul, Minn., water system, reducing water's average hardness 87 ppm at cost for chemicals of $3.51 per million gallons; stabilization of water with carbon dioxide obtained from stack gases of power plant purified by scrubbing and drying; recarbonation of water.

WATER SUPPLY, HYGIENE. Pollution and Emergency Disinfection of Rochester's Water Supply, E. Devendorf. *Am. Water Works Assn.—J.*, vol. 33, no. 8, Aug. 1941, pp. 1334–1356. Report on emergency measures taken when 5 mg. of raw Genesee River water were accidentally pumped into public water supply system of Rochester, N.Y., with result that about 75% of city's 500-mile distribution system became seriously polluted; rates of chlorination at distribution reservoirs; results of residual chlorine tests; use of street flushers and fire trucks; plans for abandonment of river supply.

WICHITA, KANS. Operation Problems in New Wichita Water System, M. E. Rogers. *Am. Water Works Assn.—J.*, vol. 33, no. 7, July 1941, pp. 1233–1241. Progress report on breaking-in operations of new water treatment system of Wichita, Kans.; selection of personnel; control of well supply; coagulation experiments; filter maintenance and operation; stability of treated water; treatment with metaphosphate. Bibliography.

Equipment, Materials, and Methods

New Developments of Interest, as Reported by Manufacturers

Careyclad Protects Metal

FOR MANY YEARS, The Philip Carey Manufacturing Company, Lockland, Cincinnati, Ohio, has produced a coating for metal known as Car Cement, used by many leading railroads for rust and weatherproofing the underframes, bottoms and ends of freight cars. Carey also produces a very high grade roof coating, named Careyclad, which is reported to be unusually good for protecting iron sheets, structural steel, metal buildings, bridges, heavy machinery, ornamental iron work, and other metals.

Careyclad Coating, which includes a relatively high percentage of asbestos fiber, is highly abrasion resistant and is resistant to all three of the most commonly prevailing adverse atmospheric conditions: acid, alkaline, and salt; and also possesses high resistance in direct contact with weak acid, weak alkali and salt.

Careyclad can be applied by either spray painting, brushing or dipping at everyday indoor or outdoor temperatures. The only distinction being made is between winter and summer grade. While the melting point of the asphalt used in this coating is 220 degrees it is not recommended for use where temperatures over 180 degrees will prevail, particularly on vertical or sharply inclined surfaces.

Careyclad is a black material and can be painted over with asphalt base aluminum paint, after which, if some other color is desired, it can be painted with the various types of prepared paints available.

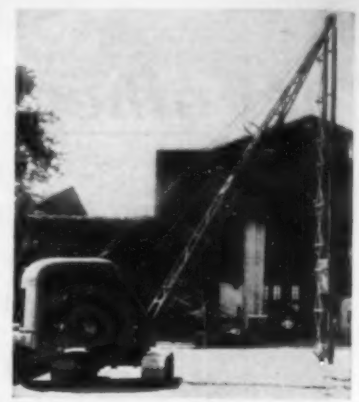
Careyclad is available from Carey warehouses in principal cities, and from Carey dealers nationwide in coverage. Further information and facts on performance will be furnished by the manufacturer.

Buckeye Crane Pile Driver

A RUGGED LATTICE TYPE pile driver attachment developed by the Buckeye Traction Ditcher Co., Findlay, Ohio, greatly increases the utility of their Clipper Crane.

The leads of the unit are suspended from the boom point sheave shaft and are secured so that they can be quickly unhooked. Leads or gibs are 30 ft long and of heavy channel steel construction. The drop hammer weighs 2,000 lbs, is quickly reeved and responds instantaneously to the vacuum power control by means of which it is operated. An impact resistant pile cap is designed to guide and protect wood piles being driven.

Pile driver units are available with the Model 50, 5-ton; Model 60, 6$^1/_2$ ton; or Model, 70, 7-ton Clipper Cranes, any of which will hoist wood or steel piles into position for driving. All three models are quickly convertible to shovel or trench hoe or can be rapidly reeved for clamshell bucket or dragline operation.



Scraper for "Caterpillar" Wheel Tractor

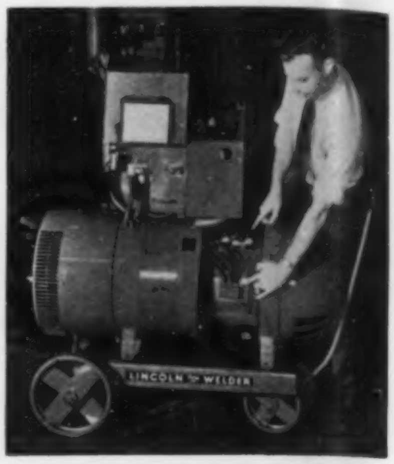
A NEW CARRYALL SCRAPER, for use with the new "Caterpillar" four-wheel tractor, is announced by R. G. Le Tourneau, Inc., Peoria, Ill. This scraper, Model DLS, has a rated capacity of 8$^1/_2$ cu yds struck and 11 heaped yds and is operated by cable from a standard power control unit.

The Model DLS is very similar to the Model LS, which is powered with the Model C Tournapull. It has the same steep, long blade base, high sides, and built-up apron. Chief changes are in the yoke for mounting on the pulling tractor and the position of the power control unit.

Cutting edge is 8 ft 6 in. With the apron cable dead-ended on the apron, all hoist and unloading cables are now placed out of the dirt, eliminating cable wear.

Welding Sets Protected

COMPLETE PROTECTION against heat, excessive current, or both, is provided by a new protective control device for arc welding machines just announced by The Lincoln Electric Co., Cleveland, Ohio.



According to the manufacturer, a welding machine equipped with this new Lincoln Device, which provides protection against burn-out, can be operated at maximum capacity for long periods without harm. The control device consists of two current transformers (upper devices in illustration), the primaries of which are connected in series with the motor leads and the secondaries supplying power to operate two snap-action thermostats which are mounted directly on the motor lamination (lower device in illustration). These thermostats are connected to the lamination in such a way that they operate by means of heat conduction as well as by current passing through the thermostat.

Both high input current and high motor temperature combine to open the thermostats. When the motor returns to a safe operating temperature or when the current is reduced, the thermostats automatically reset, and no manual operation is required to start the machine, except pushing the start button.

Reynolds Metals Capacity

PRODUCTION OF FABRICATED strong aluminum alloy sheet, rod, and extruded shapes in the plants of the Reynolds Metals Company has been increasing steadily for several weeks and new plant-units are going into operation. R. S. Reynolds, president of the company, has announced that by early fall Reynolds Metals plants alone will have the facilities for fabricating strong aluminum alloy sheet, rod, and extruded shapes, equal to the total of these defense items made in the United States as late as 1940.

The Reynolds Metals Company operates 25 plants in 13 states, almost all of them being largely devoted to national defense production. The Reynolds aluminum plant at Listerhill, Alabama, now is in production, the first runs of virgin aluminum having been made in less than six months after ground was broken for the plant building.

All-Welded Dipper

A number of significant features are said to have been incorporated in the new P&H cu yd welded dipper announced by the Harnischfeger Corp. of Milwaukee, Wis., for their Model 655-A Excavator

Besides stability gained by the welded construction, there are the advantages of a renewable manganese lip renewable dipper teeth, and improvements in the latching mechanism. By providing a heavy shell, simplicity of reinforcements, and an exceedingly sturdy padlock frame with large sheave, a maximum in over-all strength and rigidity has been secured, it is claimed. Also important is the absence of corner welds—a feature achieved by forming the dipper back of the parent metal instead of the inserted plate type back.

Trackson Pipe-Layer

Trackson Company announces a new Model MD6 Pipe-Layer—a tractor side-crane that mounts on the new "Caterpillar" D6 model and takes full advantage of every improvement built into this latest "Caterpillar" Tractor.

The new MD6 Pipe-Layer has a lifting capacity ranging from 7,300 lb at 12 ft overhang, to 23,700 lb at 4 ft overhang, and is one of a complete line of Trackson Pipe-Layers available with lifting capacities up to 67,000 lb.

These husky "Caterpillar" tractor-mounted side-cranes have the power, speed and traction required for all conditions, and can be equipped with the Trackson "Anglefiller" that permits any Trackson Pipe-Layer to bulldoze, backfill, level or spread. Bulletin 459, available from Trackson Co., Milwaukee.

INDEX OF PRODUCTS

Acetylene
Air Reduction Sales Co.

Acetylene Generators
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Airport Drainage
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Aluminum, Structural
Aluminum Co. of America

Anchors for Fenders and Tunnel Forms
Richmond Screw Anchor Co., Inc.

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Philip Carey Mfg. Co.

Bars, Aluminum
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Chicago Bridge & Iron Co.

Batching and Weighing Equipment, Concrete
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Dual Power Pump Drives

UNINTERRUPTED TWENTY-FOUR HOURS a day water supply from deep well turbine pumps is provided by dual drives, according to the announcement of engineers of Peerless Pump Company.

Normally equipped with electric motor head, the secondary drive may be by right angle gear, powered by a gas, gasoline, or Diesel engine or steam turbine. Upon interruption of electric service, the stand-by plant can be started instantly, either by the operator or by completely automatic control, providing a never-failing source of supply. Other types of dual-drive pumps have steam turbines as primary power, with internal combustion engines connected with the secondary right angle gear. Either source of power operates independently of the other.

Details may be obtained from Peerless Pump Co., 301 West Avenue 26, Los Angeles, Calif.

New Layne & Bowler Shop

ONCE MORE Layne & Bowler, Inc., of Memphis, Tenn., have found it necessary to add to their production facilities. The latest addition is an entirely fireproof all-steel pipe and screen shop covering 8,800 sq ft of new manufacturing space for use in making well water screens and welded pipe.

Straight line fabrication has been adopted, thus placing in one building all machinery required in the making of well water screens and pipe. Production has been increased over twenty-five per cent. Large contracts for additional government work have necessitated increased production throughout the entire plant.

New Decimal Equivalent Wall Chart

THE NEW POST DECIMAL Equivalent Wall Chart is available to those who ask for it on their business stationery. It is of giant size, 26 in. by 39 in., is printed in two colors in large heavy type, and can be easily read fifty feet away.

This New Decimal Equivalent Chart carries all the equivalents from 1/64 to 63/64. Address The Frederick Post Co., 3650 N. Avondale Ave., Chicago, Ill.

Literature Available

ALUMINUM—To serve the growing needs of the defense industries for up-to-date technical information, Aluminum Company of America, Pittsburgh, Pa., is issuing a series of service bulletins, which will list the most recent work of their technical departments. Aluminum Service Bulletin No. 1 gives 100 references on aluminum of special interest to manufacturers of defense materials.

ARC WELDING COSTS—Cost of arc welding electrodes can be estimated rapidly for any type of joint with either bare or coated electrodes by the use of the new Airco "Electrode Consumption Calculator." It tells how many pounds of electrodes are required and the amount of steel deposited per lineal foot of weld, in making fillet welds, square groove butt joints, "V" and "U" groove butt joints, bevel grooves and "J" grooves. For copies of the calculator, write to Air Reduction, 60 East 42nd St., New York, N.Y.

ARC WELDERS—A new thirty-eight page catalog describing the complete line of Hobart "Simplified" Arc Welders and Accessories will be sent upon request to Hobart Brothers Co., Troy, Ohio.

FURNACE FOR SEWAGE—The Multi-Zone Multiple Hearth Furnace of Underpinning & Foundation Co., 155 East 44th St., New York, N.Y., is described and illustrated in a new booklet. Design, operation, and existing plant installations are covered.

SAND FILTERS—The construction, operation, and many performance records of "Municipal" Sand Filters are given in a new booklet published by Underpinning & Foundation Co., Inc., 155 East 44th St., New York, N.Y.

SEWAGE PUMPS—The Biofiltration System of sewage treatment and the application of Fairbanks-Morse Vertical Propeller Pumps are described in detail in Bulletin 6301. Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago, Ill.

STREET FORMS—Blaw-Knox Co., Pittsburgh, Penna., has issued a new bulletin No. 1828, on steel street forms. It presents diagrammatic sketches and photographs of form installations for concrete curb, curb and gutter, integral curb, sidewalks, flexible and fixed radius forms.

INDEX OF PRODUCTS

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